# Consulting Engineer

June 1961

HAROLD P KING, member of the Sherman Oaks, California, consulting structural engineering firm of King, Benioff & Associates, is a quiet man, more prone to diagnosis than prognosis. Thus, his election to the presidency of the Consulting Engineers Council could not have come at a better time. Harold King sees a very bright future for the Council, but he also recognizes that it has undergone an extremely rapid growth since its formation in 1956. It is about time that we gathered our skirts together," says King, "and consolidated the gains we have already made." Continued on page 10

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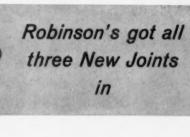
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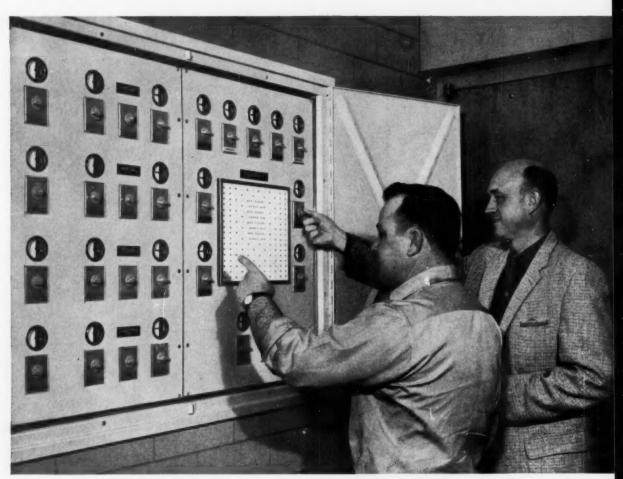
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Building Operating Engineer and Superintendent, R. T. Malone, and Capital Improvements Inspector, J. S. Youmans, at the lighting section of the master pneumatic control panel.

# How they blow on the lights at Bowling Green State University

Fulfilling a request for centralized control of heating and ventilating for a multi-purpose building is both a logical and standard procedure. But at Bowling Green's Memorial Hall, the plans also called for selective control of the building's 248 assembly hall lights from the same location. Architect-engineer, James E. Allen, not only took the situation in hand—he put all operations through a single master panel.

The panel is entirely pneumatic. As such it provides maximum efficiency for heating and ventilating. Ingeniously, too, it greatly simplifies the electrical system. Small copper lines pneumatically activate the switches in the 4 lighting distribution panels. This eliminated a separate and costly wiring network which would have required at least eleven ½-in. conduits strung above the truss work.

The pneumatic control panel is located in a corridor adjacent to the arena area. The left hand section controls heating and ventilating. Switches regulate fans and dampers for summer and winter conditions and also provide for quick warm-up when required. The right hand section gives visible selective control of various lighting arrangements by means of a color coded layout chart. Lighting in any part of the arena assembly hall area can be regulated as desired and instantly verified.

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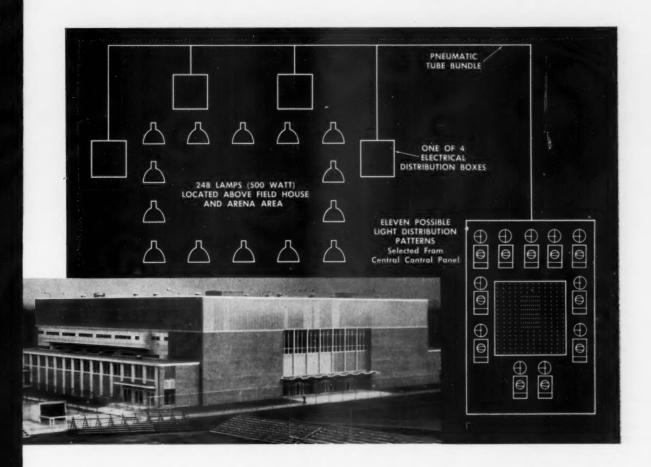
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It is easy to see why King is concerned about consolidation. The Council has about 40 standing committees and a number of temporary ones. Past presidents have found, to their sorrow, that it is next to impossible to maintain close contact with all of these activities. In fact, most of them readily admit that they were unable to accomplish all of the things they set out to do — mainly because the present organization has grown more unwieldy in almost direct ratio to the growth in membership.

King proposes to begin his term of office with a study of the many CEC committees. "I do not believe that we can afford to abandon any of our committees," King says, "but I do feel that some of them are of greater current importance than others. We probably can achieve more if we select these and concentrate our efforts on immediate rather than long term gains."

To illustrate his point, King referred to the publication of contract documents developed by a CEC committee from the Intermountain Institute of Consulting Engineers. "Some members of the Council opposed publication," he said, "because they felt we should move slowly and withhold publication until we had the material in almost perfect final form. Actually, there have been few objections, and we provided a definite service for our members by not delaying publication."

With its growing membership, CEC's board of directors is growing large and cumbersome. There is need for streamlining the procedures of this governing body so that business can be handled with dispatch. But it also is important that a truly democratic approach be maintained. King believes that it is vital for the individual member of CEC to become interested in national problems. He feels that this might be achieved by inviting members of member organizations to attend CEC board meetings and thereby gradually increase their interest in CEC. In this way, the deliberations of the board would be opened up to a limited audience, and more efficient procedures could be developed. The general membership in attendance would then get an almost immediate report of board activities and would be able to aid the delegate from each organization in presenting the accomplishments and problems of CEC to its members at home.

King points out that CEC has had close liaison with the American Society of Civil Engineers and the American Institute of Consulting Engineers for the past few years. However, he feels that CEC should improve this relationship and develop mutually beneficial contacts with other national organizations.

Coming from California, Harold King is well aware of the inroads government engineering bureaus are making in the traditional areas of private practice. For

example, the state legislature of California is now considering a bill that would continue to force state schools to use the State Board of Architecture for their construction programs, rather than retain the services of architects and engineers in private practice.

It is important, according to King, that CEC use its Private Enterprise Fund to fight government invasion at all levels and in all areas. He feels that this goes far beyond the narrow boundaries of self-interest. In this CEC activity, King sees a significant contribution to the preservation of the free enterprise system in the United States economy.

When pressed about the establishment of CEC's Washington office, King pointed out that everyone agrees this is a must. "Where we cannot seem to achieve agreement is in setting up a dues structure that will enable us to afford it. I think," King said, "that we must go to Washington. However, before we do, we must have the necessary funds. We in the California Association have a rather substantial budget for our own state activities, and this is clearly reflected in our dues structure. Perhaps we can educate other state associations so they will realize the value of temporary financial sacrifice, through higher dues, to achieve long term benefits. It would be foolhardy for us to attempt to set up an office in Washington on an inadequate budget." King feels personally that perhaps CEC will be in Washington sometime in 1962.

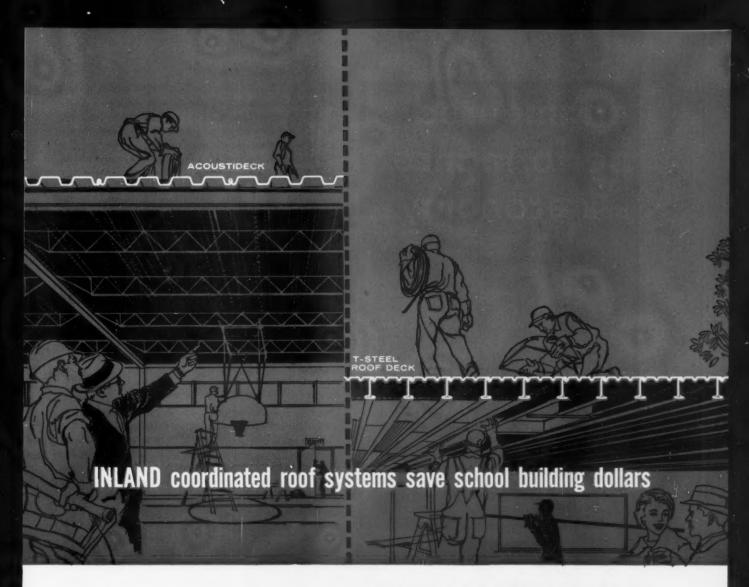
Though he is not personally interested in overseas projects, King recognizes that some CEC members are interested in the Federation Internationale Des Ingenieurs-Conseils (FIDIC) for this reason. However, he believes that liaison with FIDIC is important for the broader reason that it ties CEC into a worldwide fraternity of consulting engineers. "As part of an international group," says King, "we take on additional stature. We identify ourselves as being part of a group which is not only important in our local area, but throughout the free world."

#### Iowa to California — Via Pittsburgh

Harold King was born in Iowa, and attended grade and high school in Sioux City. His father had ambitions for his son to become a farmer, but King remembers that he always was more interested in engineering. The family was not too surprised, therefore, when he ended up with a B.S. in Architectural Engineering from Iowa State College, at Ames.

Incidentally, King had a little better luck with his own son Jack, who joined the firm of King, Benioff & Associates in 1957, after a tour of duty with the U. S. Air Force and structural design experience with the firm of S. B. Barnes & Associates. Jack is a registered civil engineer in California, and one of three associates in his father's firm.

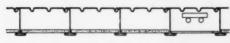
It took Harold King seven years after college to succumb to the lure of California in 1931. He spent those





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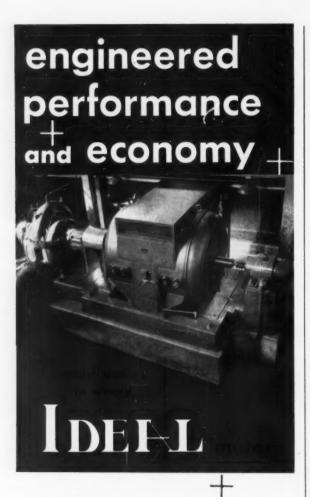
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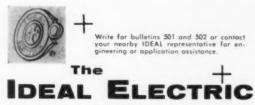
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seven years with the McClintic Marshall Company and the architectural firm of Janssen and Cocken, in Pittsburgh, Pennsylvania, working as a structural designer. Among his Pittsburgh projects were the Penn Sheraton addition and the former Keystone Club.

Arriving in California, King joined forces with an architect to enter the private practice of architecture and engineering under the firm name of Barcume & King. This partnership was broken up by World War II, when King entered the U. S. Navy Civil Engineering Corps, in 1942.

After a year of stateside service, King was ordered to the South Pacific in charge of a camouflage unit. He spent three months in Bougainville and served as material officer for the Green Island invasion. Later, he was sent to the 5th SeaBee Brigade and took part in the invasion of Guam. He remained there for one year, working on camp, road, airfield, and waterfront construction. King remained active in the Naval Reserve after his discharge, and now is retired with the rank of Commander.

#### From Partnership to Corporation

Back in Los Angeles, King opened a structural design office in 1945, and was engaged primarily in interprofessional practice. In 1950, he moved his office to Sherman Oaks, and six years later formed a partnership with Ben Benioff, a long time friend. The firm now has grown to include the two partners and three associates, although the principals intend to keep their firm relatively small.

King and Benioff have recently incorporated their firm. King has no strong feelings on this controversial subject, but he does hope that the firm will carry on long after he is no longer active in it. As King puts it, "The professional standards by which a consulting firm is guided are basically those of the principals. It is inconceivable that our staff will abandon these standards, merely because the founding principals are no longer active in the firm. Since incorporation offered the simplest approach to insuring the continuity of King, Benioff & Associates, that is the one we chose. Of course, there can be other benefits from incorporation, but for us they were not governing factors."

#### **Relations With Architects**

Having worked all sides of the architectural-engineering triangle, Harold King is probably more intimately aware of the problem of architect-engineer relationships than most consulting engineers. He has worked for an architectural firm, been a partner in an architect-engineer firm, and is presently in a practice that specializes in structural engineering. While primarily engaged in interprofessional practice, King does not hesitate to take over as the prime designer when a project is primarily engineering. However, he is not in favor of the engineering firm hiring a few architects

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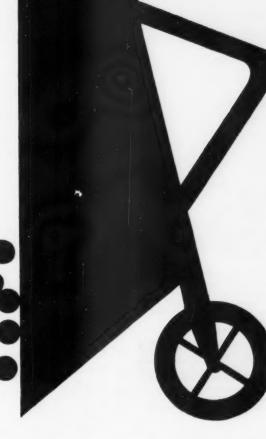
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or the architectural firm hiring a few engineers. In his opinion, most projects clearly fall into either the engineer's or the architect's field of activity. When they do not, it is less important that one or the other acts as prime designer for the project, than it is that fees be established on an equitable basis so that neither profession suffers financially.

#### Favored — The Lump Sum Fee

Win, lose, or draw, King prefers to work for a lump sum fee. He is opposed to the percentage of construction cost fee, for too often the end figure bears no relation at all to the work performed by the consulting engineer — particularly on small jobs, where a likely result is loss instead of profit. It is King's belief that the consulting engineer should be familiar enough with his costs to establish an equitable lump sum fee that will allow him to give his client's project the attention it requires without losing money.

King Benioff & Associates has not sought out large projects. However, the size of a project is seldom a measure of its complexity, and the firm has been involved in some extremely interesting design problems. The Valley Presbyterian Hospital, with its circular plan, is one that King remembers with enthusiasm. Another is the Fair Exhibit Building on the Los Angeles County Fairgrounds, a structure which was roofed by a steel lamella arch fabricated of 16-in. deep bar joists supported on concrete thrust girders at the top of the buttresses. The firm also has done a number of structures with interesting designs using glued laminated timber members.

#### An Active Association Man

Harold King's relaxed manner belies a remarkably active career in association work. He has been president of the Structural Engineers Association of Southern California, Structural Engineers Association of California, and the Consulting Engineers Association of California. In addition, he has been on the board of directors of each of these groups, has been the California alternate delegate and delegate to CEC, and was first vice president of CEC before taking over as president this year.

King also is a member of the American Society of Civil Engineers and the American Concrete Institute. But his activities are not limited by his own profession. For example, he is a long time member of Kiwanis International, and has held the president's reins in two of the clubs to which he belonged.

It is evident that CEC is not buying a pig in a poke. Harold King has a remarkable record of association activity which should stand him in good stead through the coming year. While his major goal for CEC is consolidation, he fully intends to see that the organization continues to grow — both in size and in stature.

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#### **Century City**

Have just received the April issue of Consulting Engineer, and it is a most interesting issue. I do notice an item on page 198, on Century City, that I would very much like to correct.

We are the architects and engineers for the Century City project, which is much more than a home site development. It ultimately will be a \$500 million integrated community, with high rise apartments, office buildings, a hotel, and a shopping center. We are doing all design and engineering, including roads and bridges. Daniel, Mann, Johnson and Mendenhall is doing working drawings on the civil engineering part of the project.

We expect to have further information on this in the near future, as the first office building and other important facilities are nearing construction status.

Ralph Jackson, Public Relations Welton Becket and Associates Los Angeles

#### **Boston Tunnel**

On page 96 of your April 1961 issue you stated that the design of the Boston Central Artery tunnel was made by Fay, Spofford & Thorndike, Inc.

The material we sent you included a statement that the design was performed for the Massachusetts Department of Public Works

# Readers' Comment

by Fay, Spofford & Thorndike, Inc., and Charles A. Maguire and Associates, of Boston.

We shall appreciate your carrying this correction.

W. L. Hyland, Vice President Fay, Spofford & Thorndike, Inc. Boston, Massachusetts

Also, the April 1961 Consulting Engineer failed to give proper credit in the "New Projects" item, "Moving a City." The names of Edmundson & Kochendoerfer, architects, and R. Evan Kennedy, structural engineer, should have been included in the design and planning team.

#### **CEAC** Meeting

Your April issue is packed with material of interest to every one of our CEAC members, individually, and to our Board of Directors, as a group.

It was just last Saturday that one of the engineers' groups in California voted to rescind the canon in its Code of Ethics dealing with competitive bidding practices. This is in interesting contrast to the text of your NSPE report, and to the recent restatement of ethical practices by ASCE.

Similarly, your "Tranquil Tower" hit a sensitive point, at a time when our legislature in Sacramento is considering a dozen or more bills which, if passed, could substantially undermine the safeguards to the public safety, and, in the process,



"Century" non-code station — a symbol of the same dependable protection, in buildings, that the familiar Gamewell street box brings to most of our cities.

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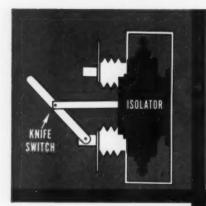
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eliminate the private practice of consulting engineering in the State of California. The threat of unregulated corporate practice is only one dangerous situation.

Raymond C. Kelly Executive Secretary Consulting Engineers Association of California

#### Another Fan

I have been receiving your magazine for approximately one year and I want you to know that I consider it a very fine publication. The information contained therein is timely, well written, and provides a survey of the various fields of consulting engineering not readily obtainable in any other single publication. I look forward to receipt of each new issue.

Wayne A. Farley Structural Engineer Sioux City, Iowa

#### Second the Motion

I refer to the letter from Mr. Lindsay H. Welling recently published in Readers' Comment (March, 1961) on the subject of Canons of Ethics.

I heartily commend Mr. Welling's suggestion that Consulting Engineer establish a forum or column devoted to technical information on construction products that would circumvent the misdirection and violation of professional ethics that characterizes a great deal of the current advertising of such products. Mr. Welling terminated his letter with the question "Does anyone second the motion?" The writer unhesitatingly does.

Mr. Welling's protest is one that ought to be seriously heeded by not only the profession itself, but by the agency whose function it is to control the kind of practice of free enterprise in which the bounds of the word "free" are stretched beyond all the limits of technical veracity.

> Leo Libertson Consulting Engineer New York City



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#### From the Editor's

#### Tranquil Tower

#### Associate or Incorporate?

It is an unfortunate reality of American life that, under the law, the impersonal corporate entity has been granted many favors not available to individual proprietorships and partnerships. Thus, though the professional man still may bask in the waning warmth of public adulation, he hardly can hope to attain the level of affluence enjoyed by the corporate executive. We still are prone to listen attentively to our doctors and our lawyers, but we argue with our architects and ignore our engineers. Professional prestige seems to be fading fast, but professional income may be fading even faster.

Under present conditions, a professional can hope to achieve financial security in only two ways. He can (1) associate, or he can (2) incorporate.

The latter alternative has already been suggested to the legal profession in the July 1960 issue of the American Bar Association Journal. It would require special legislation by the states, but it would offer many financial advantages to professional practitioners in all fields. For example, it would permit:

¶ The creation of special pension and profit sharing plans in which principals could participate.

¶ Election of taxation as a partnership or as a corporation, whichever proved more advantageous.

¶ The creation of deferred compensation plans for principals as employees.

¶ The establishment of stock option and stock bonus plans for younger members of a firm.

¶ The purchase of corporate insurance on the lives of stockholder executives.

Professional engineers currently are waging a bitter battle over the question of corporate practice. They recognize, as do other professionals, the dangers that will beset them as professional people in the employ of a corporation. Some feel that legal controls can reduce these dangers, while others flatly state that the corporate business structure is incompatible with the practice of a profession.

The fact remains that the advantages to be gained by corporate professional practice can be achieved more readily because they require action on a state rather than a national level. Thus, proponents of corporate practice point to the failure of the professional organizations in their efforts to obtain Congressional approval for the Keogh bill. To them, the alternatives of association and incorporation are not alternatives at all. They are convinced that efforts at association already have failed.

Meanwhile, the Michigan Association of the Professions is still alive and kicking. If it can go national, and create a true association of all of the professions, it may be able to achieve what other associations so far have been unable to do — even to the extent of getting the Keogh bill, in desirable form, through Congress. However, at this point MAP is only two years old. It is still too young to attempt to evaluate its future influence. Also, as the Consulting Engineers Council grows in stature, there remains the fact that, in terms of national unity, it still is weakened by the very existence of the NSPE functional groups — some of which are extremely important.

It is apparent that the professions have arrived at a crossroad. If the pro-corporate professionals are thinking only in terms of financial security, they must face the danger of swapping money for prestige. On the other hand, if the anti-corporate professionals are in opposition only because they fear competition from large firms, they too may suffer some undesirable consequences. It is axiomatic in our free enterprise system that the world owes no one a living, nor is bigness wrong per se.

The question before the professions is: Shall we (1) associate, or (2) incorporate?



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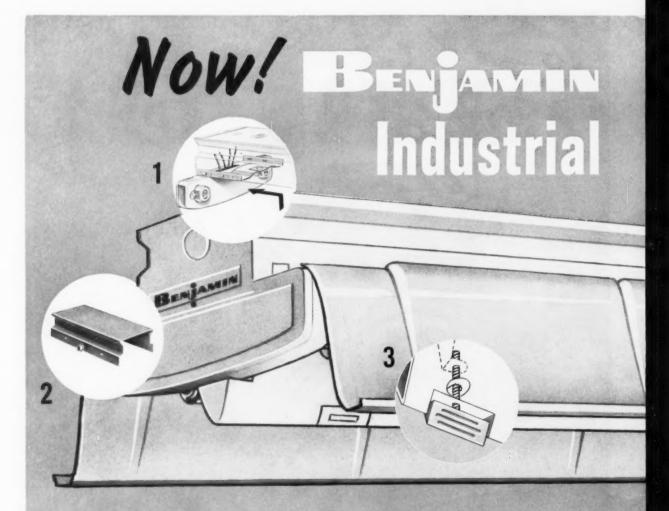
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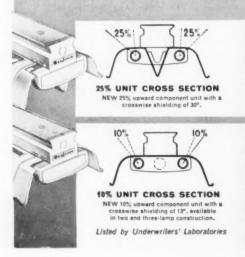
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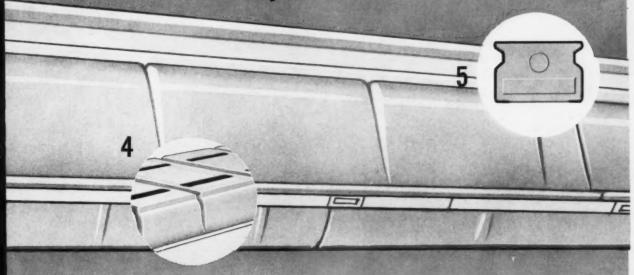
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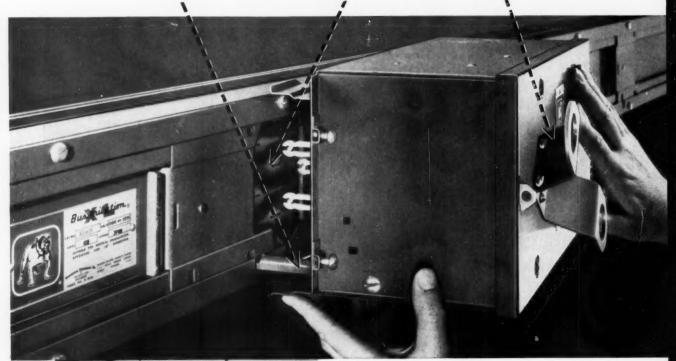


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#### The Legal Aspect

DR. MELVIN NORD

Registered Engineer Attorney at Law

Corporate Practice . . . The Real Issues – II

LAST MONTH we began a study of the current battle over corporate practice in the State of Washington. This month we will consider the proposals made by various parties to the dispute.

The two major groups concerned are the Washington Industry Committee on Engineering Practices and the Washington Society of Professional Engineers. The Committee proposes that corporations be allowed to continue the practice of engineering in Washington as the present law allows. The Society proposes amending the law.

#### WICEP

The Washington Industry Committee on Engineering Practices consists generally of officers of large companies that want to be allowed to use the services of large engineering corporations. The present Washington law, as backed by the Committee, requires only that a registered engineer be designated as responsible for the practice of engineering by a corporation, and that he have full authority to make all decisions on behalf of the corporation. The WICEP argues that any other restrictions on corporate practice would be discriminatory, and harmful to the public.

Is it sufficient to require that full engineering authority be given by the corporation to a registered engineer? If this were realistic, why would this highly responsible registered engineer need the corporation in the first place? Why couldn't he do it all with other engineers employed by him, or acting as partners? Obviously, the answer is the economic power of the corporation. But if the corporation has such power, does it take orders from this mighty engineer, or does he in fact take orders from it? Unquestionably, the man who holds the purse strings - not the man who holds the slide rule - is the one who ultimately controls. The theory that this super-engineer really controls the project, even from a strictly engineering point of view, is sheer fantasy.

The theory that this one man dictates to the corporation is not only factually hogwash, but is also pure nonsense from a legal point of view. A corporation is not permitted by law to agree to place the exclusive control of important matters in any one other than its board of directors (or, to some extent, the officers of the corporation). Who is kidding whom?

It would be different if the engineer personally contracted with the client, and then employed the engineering corporation as a subcontractor to help him. Theoretical-

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Water treatment news for the consulting engineer

Large Volume Softening-Filtration In A Minimum Space

by J. S. Kneale, Manager, Cold Process Section The Permutit Company



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It is a combination Spiractor—Automatic Valveless Gravity Filter treatment system. Here are the answers to the questions most frequently asked about this type plant.

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If you would like more information about this type system, or either of these Permutit water conditioning units, please write to Dept. CNE-61, Permutit Division, 50 West 44th Street, New York 36, N.Y.



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ly, he would be able to give orders to the corporation. But it will not work that way in reverse.

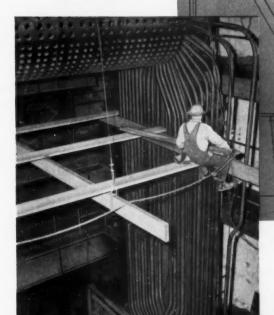
It is an open secret that what this super-brain actually is called on to do is to stamp his seal on a variety of papers which someone holds before him. He is like that other great invention of the law, the notary public, who always is taking mythical "oaths" from people he "knows personally" (never having seen them before or since). He is, in short, a figment of the imagination.

#### **Discriminatory Control?**

The members of this Industry Committee say that any further control over corporate engineering practice is discriminatory (and that just is not nice). This is a rather odd argument for them to make. In the first place, if there is any discrimination in this matter, it is not against them but against someone else. So why are they complaining? In the second place, it is by no means discriminatory, since every one else who offers to practice engineering must be qualified under the law. It is not the aforesaid mighty engineer offering or contracting to practice engineering, but rather the unregistered corporation. Why should it be allowed to do so at all?

Not only is the argument about discrimination unsound in principle, but, in my opinion, it comes with ill grace from the representatives of large industrial and engineering companies. I would simply ask these companies if they have clean hands themselves. Have they always been free of discrimination in their employment policy - as regards for example Jews, Negroes, and Orientals? If so, more power to them, but I believe otherwise.

This is not to say that there is no point to the view of this Committee. As indicated last month, I believe that all the solutions so far proposed are unsatisfactory. The arguments presented by this Committee are unconvincing, and certainly do not prove that the so**Union Starch** Installs a Modern **Coal Fired** Steam Generator



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lution is laissez-faire, as concerns corporate engineering practice.

The Washington Society of Professional Engineers favors amending the present statute thus:

Require the corporation to submit to investigation of its competence to practice engineering (except if a majority of the ownership of the corporation is held by registered engineers, or if operated solely by registered engineers).

¶ Provide that the corporation "together with its director and officers for their own individual acts are responsible to the same degree as an individual registered engineer, and must conduct business without misconduct or malpractice."

¶ Recognize additional types of misconduct which appear to have in mind possible conflict of interest, nondisclosure of competing interests, unfair competition (fee-cutting), and improper advertising.

The proposal that the board ascertain whether the company is qualified boils down simply to two supposedly minimum requirements. These actually are the sole requirements, as can be seen by reading the proposed statute: (1) the corporation's bylaws shall contain a provision that all engineering decisions pertaining to any engineering project in the State of Washington shall be made by the specified engineer in charge, or other engineers under his direction or supervision; and (2) the application must state the types of engineering to be practiced. These requirements are of no value. The second obviously is a mere formality. The first is also a mere formality - although it is not so obvious - since such a provision in the bylaws would amount to nothing, as indicated above. Thus, the practical effect of these provisions would be nil in almost every instance.

The exception from these minimum requirements, in favor of corporations in which a majority of the ownership is held by registered

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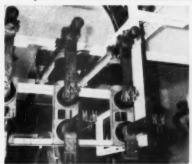
Riser Cable. In this installation, Durasheath not only serves as an aerial cable, but also as a riser cable running down the side of the building. Without additional terminations, it then drops down-inside to the plants' power-control center. It's another example of the way versatile Anaconda Durasheath adapts itself to your power cable needs.



Installed in ducts. Durasheath's flexibility meant quick and easy installation here. And once installed, its tough neoprene jacket assures long, trouble-free life. Because Durasheath adapts itself to so many uses, your inventory problems are lessened—fewer cables need be carried in stock.



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KANSAS CITY . EDMONTON . LONDON . PARIS . THE HAGUE

engineers, is obviously inadequate. What counts is the board of directors and the officers, not the stockholders. Stockholders cannot direct the affairs of the corporation.

The provision that supposedly holds individual officers or directors responsible for their own acts is pretty unrealistic. In the first place, directors never act individualy, but only as a board, and therefore rarely have any individual liability, particularly to outside persons. In the second place, the provision for individual acts of an officer is too vague to be meaningful. What acts has he committed for which he can be held liable . . . practicing without a license?

The proposals regarding malpractice seem to be pretty random in nature, and do not solve any problems of corporate practice. They seem to be directed toward making the local individual engineers more able to compete with national engineering corporations.

#### Conclusions

To my mind, these proposals are highly unsatisfactory, not just novel. You cannot make a corporation into a professional engineer - or into a person at all for that matter. Just because a corporation is for some purposes treated at law as if it were a person does not mean it really is a person. If the truth be known, a corporation is a motley group of persons, consisting of engineers, barbers, pipe-fitters, stock manipulators, old ladies, inheriting grandchildren, lawyers, criminals, and advertising executives. You cannot turn it into an engineer without a magic wand.

As engineers, we ought to wake up to the realities of the situation. It is time to scrap the formulas and to figure out what is really involved; to weed out legitimate from illegitimate objectives; to remove unnecessary restrictions based on unrealistic metaphysical notions; and to replace these flaws with rules designed to accomplish what is legitimately required

The unique sound system installed at the new Torrance facility of the Garret Corporation's AiResearch Manufacturing Division, was custom engineered to fill the many demands created by a need for efficient, instant communication, over a wide area. The 235,000 square foot facility required a versatile, dependable and total sound system. Installed by Hannon Engineering Company, Los Angeles, California.



## A TOTAL SOUND SYSTEM AT REALISTIC COST WITH FLEXIBLE MATCHED STROMBERG-CARLSON® COMPONENTS

This versatile STROMBERG-CARLSON system consists of matched components, the finest most flexible in the industry, and includes such features as:

- 14 separate paging areas (comprising a total of 80 speakers), some with total speaker selection.
- 8 widely separated microphone locations with priority sequence providing for over-ride.
- Integrated Timing Signal for automatic work time notices.
- Fire Alarm Signal-selective or total as desired.
- Can be easily and inexpensively expanded, because of built in future expansion features.

Thanks to the flexibility and completeness of the STROMBERG-CARLSON line, every requirement demanded by the new two story AiResearch facility could be met. And, it was done with a number of unique features normally associated only with costly, specifically designed equipment. For General Dynamics/Electronics, with its STROMBERG-CARLSON line, is the one audio manufacturer who can offer you virtually any type of preplanned matching component from telephone and loudspeaking intercom to selective wireless paging equipment, from radio tuner to re-entrant speakers.

For detailed information write:

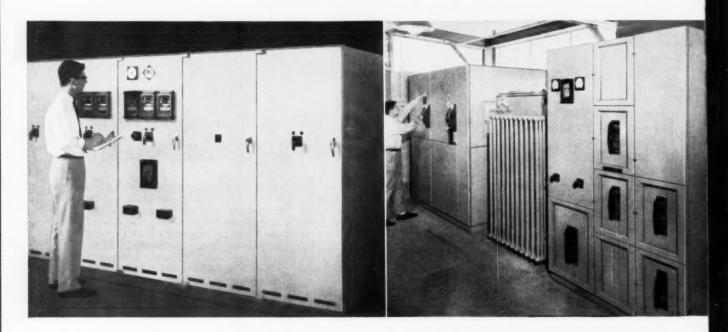
Commercial Products Division, Box C 1406 North Goodman Street Rochester 3, New York

#### GENERAL DYNAMICS ELECTRONICS

In modern business communications...THERE IS NOTHING FINER THAN A STROMBERG-CARLSON®

# OPERATION COOPERATION IN ELECTRICAL SERVICES

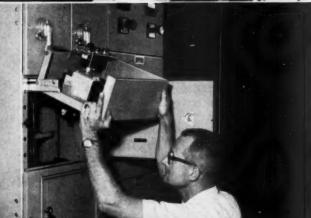
Coordinated planning between consulting engineers, their clients and Allis-Chalmers is behind many of today's most efficient and modern electrical systems. Allis-Chalmers is proud of the part it plays in providing advanced equipment such as new whisper-quiet dry-type transformers . . . new space-saving high-voltage control centers . . . and many other products. Each demonstrates the extra value that is standard with A-C . . . the greater efficiency and the added productivity which your client enjoys when you specify A-C products, systems and services. Call your nearby A-C office for details or write Allis-Chalmers, Industries Group, Milwaukee 1, Wisconsin.



Lowest height, easiest access 5-kv metal-clad switchgear on the market. Just 72 inches high, you get eye-level instrumentation, shoulder-height accessibility of component parts. Other outstanding advantages: front-accessible current transformers; maximum compartmentation and dead-front construction for greater safety; full-panel metering; rapid, one-stroke breaker insertion. Choice of Allis-Chalmers stored energy or solenoid operated circuit breakers.

Here's proven accuracy in low-voltage switchgear with 3 independent elements available in a series trip device. You can get accurate settings with calibration scales below adjusting knobs on front of trip device. Minimum, maximum and intermediate time-delay band settings are field-adjustable for each pickup value for fine selectivity. Dead-front design with drawout interlock. Operator easily inserts and withdraws breaker. Simplified engineering reduces installation costs.

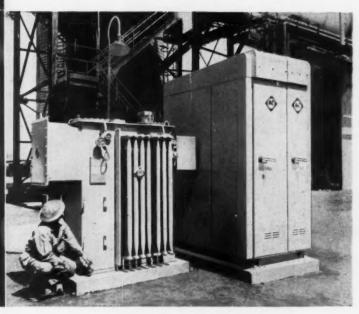




Cut installing time in half with new, whisperquiet dry-type transformers! Now 35% smaller, lighter, this new design eliminates common installation problems. Unique 3-piece case makes handling, wiring go like clockwork. You'll install them in 40 minutes instead of the usual 90 minutes. Every known factor in subduing noise has been incorporated . . . and exclusive Curvacore construction lowers exciting current, core losses. Requires no special insulating cable for hookup.

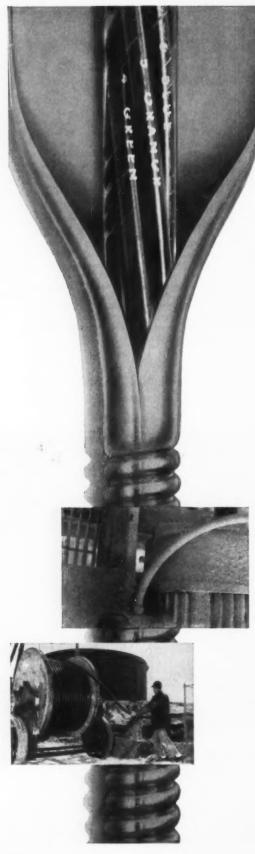
Control centers cut costs... You save space, simplify wiring and reduce inspection and maintenance expenses with new A-C low-voltage motor control centers. Plug-in terminal blocks and draw-out construction cut inspection and maintenance time by making it quick and easy to withdraw or remove control units. Pushbuttons and pilot lights on removable frames eliminate failures common with hinged wiring. Special connectors make it impossible for bus connections to loosen.





Acid drips, but open motor's efficiency never drops: This Super-Seal open motor replaced a TEFC unit driving a pump in a vanadium and uranium extracting process. Though constantly subjected to drippage of a sulphuric acid and organic phosphate mixture, it keeps right on running. Its Poxeal insulation defies corrosives, moisture and contaminants. Open design gives a service factor of 1.15 . . . provides reserve capacity to meet sudden overloads.

Lower first cost is just one of many advantages of this packaged unit substation. Simplified engineering, planning and purchasing reduce installation and maintenance costs. These A-C units provide reduced power losses, better regulation and flexibility for expansion. Factory-assembled, wired and tested to meet all standards. Transformer types available to fit your needs include oil-filled, Chlorextol liquid-filled, dry-type and sealed dry-type units.



# Only C-L-X° Sealed Cable Systems by Simplex Can do so Many Jobs so Well

Simplex C-L-X is a packaged combination of cable and an extremely pliable, corrugated metal sheath. It requires no separate duct or conduit regardless of environment. It is available with steel sheath and plastic jacketing; and with copper or aluminum sheaths, with or without plastic jacketing.

#### C-L-X Cuts Installation Costs

By using a single length of 3-conductor 15KV C-L-X for both underground and aerial use, a Southeastern utility company saved more than 20,000 dollars from what it would have cost for a complete underground duct system.

#### Resists Chemical Attack

Conduit life in this company's calcium chloride reclamation building was only 6 to 9 months. The conduit was replaced with a C-L-X cable system which — after two years of operation, shows no signs of deterioration.

#### Protects Against Liquids and Gases

An East Coast petroleum tank farm used a C-L-X 8-conductor cable protected with PVC for direct burial in ground that was saturated with oil, gas and water. Result: Perfect performance at a sizeable savings over conduit systems.

Only Simplex C-L-X offers you: Exceptional Strength . . . Unequalled Pliability . . . Protection from Liquids and Gases . . . Faster Installation and Lower Costs. Send for Illustrated Brochure containing Application and Engineering Data.

#### SIMPLEX WIRE & CABLE @

CAMBRIDGE, MASSACHUSETTS



# The Word From Washington

EDGAR A. POE, Consulting Engineer Correspondent

#### **Common Situs Bill**

The extremely controversial common situs picketing bill has passed the House Labor Subcommittee, and probably will reach the floor of the House very soon. The basic objection to the bill, from the consultant's point of view, is the provision for a secondary boycott on construction jobs. This would permit striking members of one trade union to picket an entire work site, stopping work by members of other trade unions.

Labor leaders, understandably, are strongly in favor of the measure. It would give them an additional weapon in negotiations with management, and would be a strong factor in the control of labor supply in a specific community or industry. Labor Secretary Arthur Goldberg, former attorney for the United Steel Workers and a strong pro-unionist, has maintained that this legislation is "necessary and desirable." He said he does not believe that contractors jointly engaged in a construction project are truly neutral in disputes between other contractors and their employees.

Strongest opposition to the bill is coming from the management and professional groups, led by the U. S. Chamber of Commerce. Charles Mahin, a C of C spokesman, charged that the bill would give labor officials "a Federal license for economic blackmail, by

giving them the power to threaten a third person." It is this third person factor that concerns the bill's opponents. Management officials have warned that it eventually would hurt workers as much as employers.

The consulting engineer's viewpoint was given in testimony before the House Education and Labor Committee by CEC representative James DeSerio, of Buffalo, New York. DeSerio pointed out that this common situs bill known as the Thompson bill would permit picketing of "all contractors, subcontractors, suppliers, and even consulting engineers by any union which has a dispute with any employer on a project, whether justified or not. All of the disinterested parties would become involved in the dispute and be innocent victims of a boycott . . . This bill could lead to compulsory union membership of every worker associated with the construction trades. It would restore the closed shop under which no person could work on a construction site without paying 'tribute' or dues to a union boss. It could even result in leading the construction union organizer right into the drafting room and engineering department.

"This bill could even prevent us from specifying or naming in the specifications the products of a manufacturer who was in the midst of a labor dispute. As an example: The Burt Manufacturing Company, of Akron, was caught in a secondary boycott for more than 10 years because its 150 employees all belonged to the Steel-workers Union, and the Sheet Metal Workers Union refused to install Burtmade products. It is conceivable that if one of our member organizations specified the product of a firm such as this, then the office of that firm could be picketed as being unfair to the Sheet Metal Workers. There is no limit to this . . . and it might end up that we would have to 'clear' our specifica-

James N. DeSerio (left), of Buffalo, N. Y., chairman of the CEC Legislative Committee with Congressman Carl D. Perkins. Perkins is chairman of the subcommittee of the House Education and Labor Committee, now hearing testimony on the secondary boycott effect of the Thompson common situs picketing bill. DeSerio presented CEC's objections.



tions with the construction unions before we invited bids from the contractors. This would certainly give the construction unions a strangle hold on the construction economy, with a resulting increase in all construction costs."

The National Society of Professional Engineers, which has been against the bill from the beginning, challenged union claims that all contractors on a construction project should be treated together as a single employer. "This reasoning fails completely to recognize the status and position of engineering and surveying firms and their employees at a construction project. Engineering and surveying are highly specialized services performed for a client, be it the general contractor, a subcontractor, the land developer, or the project owner. The engineer or surveyor has an inherent obligation to perform an unbiased service for his client and therefore to use his highest degree of skill and ability. He is not, by virtue of his relationship to his client, necessarily a partner or joint venturer with others engaged on the project."

Meanwhile, the Building Contractors Association of New Jersey has proposed what they term a direct and simple substitute for the "common situs" bill. Their proposed bill would give a presumption of validity to organization picketing at construction sites provided that:

¶ Picketing does not violate the picketing provisions of the Taft-Hartley and Landrum-Griffin laws. ¶ Picketing must indicate the employer with whom the dispute exists, must occur only when the employer or his employees are at the site, and must be limited to the particular location on the site where the employer is working.

#### Other Legislation

Many members of Congress have received letters from H. M. Smith, past president of Consulting Engineers Council, and other consultants, expressing apprehension over misconceptions that have cropped up involving engineering done on public works projects.

Advocates of strong central government control seem unable to understand how private consultants can perform certain types of services for a governmental agency at a lower cost than engineers working for the government.

CEC president Smith summed up the concern of consulting engineers in a letter to Senator Roman L. Hruska, Republican of Nebraska, a Member of the Senate Appropriations Committee: "In order to evaluate the matter of engineering costs on public works, important steps must first be taken. We believe that it is necessary to establish and maintain a proper cost accounting system in government agencies before a sensible comparison can be made between the actual cost of engineering done by government forces and the

ACCURATE GRAPHIC AND VISUAL REGISTRATION

of liquid flow with

## STEVENS RECORDER TYPE B-FT

Recording, indicating and totalizing meter for measuring sewage or other flows over Parshall flumes and weirs. This instrument has interchangeable flow cams and flow conversion gears... an important factor to consider for sewage treatment plants in rapidly growing communities. With a simple change of cams and gears the Type B-FT Recorder can operate with a different size flume or accommodate a greater range of flow than that for which it was originally purchased. The change does not require factory service. Similarly, change from weekly to daily time scale, or vice versa, is accomplished by merely repositioning one gear — no new parts to buy.

This recorder can be direct float operated or remotely controlled and is available for wall or switchboard mounting, or with cabinet for mounting out of doors directly over the float well. Request BULLETIN 25 for complete details.



#### STEVENS HYDROGRAPHIC DATA BOOK

Invaluable for your reference file. Contains technical data on recorder installations, plus a wealth of hydraulic and conversion tables. \$1 copy. (No COD's)

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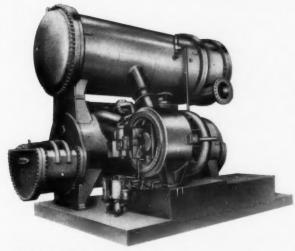
STEVEN

TOTALIZER BEGIN

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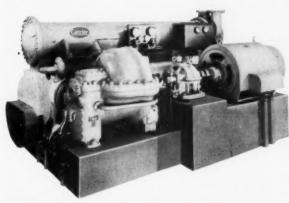
# CARRIER CENTRIFUGAL REFRIGERATION CAN BE USED WITH ANY TYPE OF DRIVE

... electric motor, steam or gas turbine, diesel or gas engine!



Carrier Centrifugal - 2000 to 5000 tons

With barrel type compressor—can be used with electric motor, steam or gas turbine, diesel or gas engine drives.



Carrier Centrifugal-100 to 2000 tons

With horizontal split casing—can be used with electric motor, steam or gas turbine, diesel or gas engine drives.

The versatility of Carrier Centrifugal Refrigeration Machines is practically unlimited for air conditioning, process cooling or low-temperature refrigeration down to minus 185 F.

They are available in the industry's widest range of capacities—from 100 to 5000 tons.

They can be powered with any make or type of electric motor—variable or constant speed, a.c. or d.c., high or low voltage—or with a high or low pressure steam turbine, gas turbine, diesel or gas engine.

Though "custom-built," they also offer the economy of standard units. Carrier manufactures standard compressors, condensers and coolers in a number of sizes. That makes it economical to combine standard components matched to your client's needs.

Since the first Carrier machine, installed in 1922, more than 5000 Centrifugals all over the world have proven the day-in and day-out dependability of Carrier refrigeration. You can specify Carrier with confidence on any project. Write Carrier Air Conditioning Company, Syracuse 1, New York. In Canada: Carrier Air Conditioning Ltd., Toronto 14.



amounts paid to consulting engineers for work done on government projects. Further, we believe that such cost accounting must be established at all levels of government. We will support any of your programs which include a comprehension of the vital role played by the private enterprise system."

The Congressional box score on major legislation showed some important bills still hanging in the air. However, it appeared reasonably certain that Congress will provide funds to continue the vast Interstate Highway construction program, provide funds for airport grants, and allocate funds to curb water pollution.

Another of the pending bills would provide tax exemption incentives for voluntary retirement plans. This will be particularly important to consultants and other self-employed persons who are discouraged, under the existing income tax set-up, from establishing retirement funds. The House Ways

and Means Committee already has reported favorably on the bill.

#### Airports Needed

The Federal Aviation Agency reports that a total of 465 new airports should be built and 2834 existing airports should be improved if the nation's civil aviation needs are to be met over the next five years. The estimate was made in the Agency's National Airport Plan for 1961, which lists, city by city and state by state, those airports requiring improvements and those communities where new airports will be needed.

While no Federal funds are provided by the National Airport Plan, the total cost of the improvements projected in the Plan is estimated at approximately \$1.1 billion over the five-year period. Nearly \$900 million of this amount would be needed for purchasing land, preparing the site, and for paving runways, taxiways, and aprons. The remaining \$200 million in-

cludes the cost of installing runway and guidance lighting, improving or building FAA control towers, and establishing public use facilities.

#### **Standard Forms**

Industry representatives are studying the semifinal version of a new standard form questionnaire prepared by the General Services Administration. Designed to assist engineers and architects in preparing questionnaires for use in Federal agency contracts, the form still must be approved by the Bureau of the Budget.

Lyle Jones, a Washington representative of CEC, has been working with the Advisory Council on Federal Reports in connection with the new form. After the industry representatives finish their evaluation of the proposed form, the engineering and architectural groups will be invited to add their comments. The Bureau of the Budget will make the final decision.



## Now...Time for the Boys



#### Electrical Problems No Longer Short Circuit Our Family Fun

Sure, a father should be a pal to his sons . . . and, mine are at the age when they need and appreciate my companionship most. But when you're lucky enough to be employed at an assembly plant that's doubled capacity twice in the past eight years, you've got more than a full time job . . . and family activities frequently have to take a back seat.

During these eight years I've come up through maintenance to Assistant Plant Manager. It started when I suggested we replace certain trouble-some motors with silicone insulated units. Then, when we doubled our plant the first time, I suggested we could double our electrical load capacity in the same floor space by using silicone insulated transformers. Just before our last expansion, my boss was made Plant Manager and I moved up to his assistant. He's taught me a lot . . . and I think I've helped

him. We're a good team. And, for the first time since I started working, I'm finding time to really enjoy my boys. By the way, the car we're restoring is a Model A. No, not a Ford...a Dusenberg.

I think my progress is the result of plenty of hard work and a good eye for new and better ways of doing things. One of the most important things I've ever read was an advertisement on Dow Corning silicone insulation for electrical transformers and motors—just as you're doing now. I wrote for more information. Why don't you?

For brochure, "Specify Silicone Insulation and Save", Write Dept. 3018.

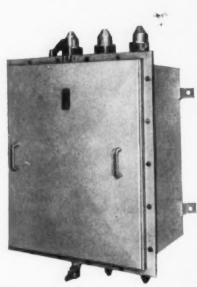


Dow Corning CORPORATION

MIDLAND, MICHIGAN

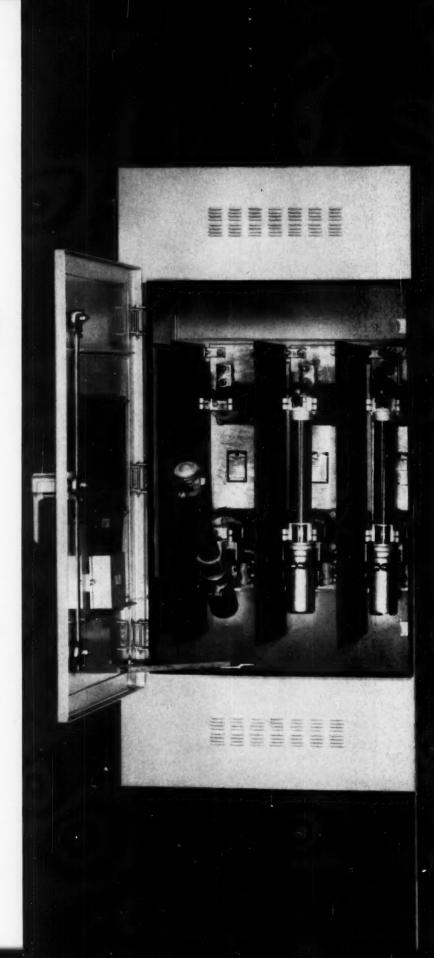
ATLANTA BOSTON CHICAGO CLEVELAND BALLAS LOS ANGELES NEW YORK WASHINGTON, B. C.

Who ever heard of hanging 500,000 kva on a wall?



Submersible style for use in basements or vaults where flooding is a possibility.

Indoor-outdoor style for general application where there is no possibility of flooding.





# Do it with S&C's new line of high-voltage metalclad fuses for wall mounting

Here is a steel-enclosed fuse that gives you economical and fully adequate highvoltage fault protection for small loads:

- 1. At service entrances;
- 2. On transformer primaries;
- 3. At underground sectionalizing points.

S&C's new line of metalclad fuses combines economy with high fault interrupting capability. Their compactness permits wall mounting, eliminating the floor area requirements of conventional free standing metalclad switchgear. And much less room height is needed.

These fuses are especially suited to applications that justify fault protection only—applications where infrequent load switching (and isolation for rare fuse replacement) may be done elsewhere.

To permit you to tailor the new S&C Metalclad Fuse—Type SM to your particular requirements, a complete selection of features and ratings is available:

- Indoor Style, Indoor-Outdoor Style, or Submersible Style
- 4.8 kv or 14.4 kv
- 200E or 400E continuous amperes
- Cable entrance by knockout, flangemounted pothead (1/C or 3/C), or integral pothead (1/C)
- 45,000 kva to 500,000 kva fault interrupting, in convenient steps

For further information, call your nearest S&C Sales Office. Consult the Yellow Pages under "Electrical Equipment" for the telephone number and address in all principal cities.

#### **S&C ELECTRIC COMPANY**

4436 Ravenswood Avenue - Chicago 40, Illinois Specialists in High Veltage Circuit Interruption since 1911



## YOU CAN COUNT ON POWELL VALVES

Performance proves it, year after year—you can count on Powell Valves to help you solve the toughest flow control problems of handling water, oil, gas, steam, air or corrosive fluids.

This truly dependable performance results from many things—among them Powell's engineering know-how, accumulated during 115 years of valve manufacturing . . . and skillful use of the widest

selection of quality materials—bronze, iron, steel and alloys.

Then, too, you can count on getting the Powell Valve you need, when you need it. That's because Powell maintains a network of distributors backed up by factory inventories, warehoused "ready to go."

Get the full story from your nearby Powell Valve Distributor, or write us direct.



115th year of manufacturing industrial valves for the free world

#### POWELL DEPENDABLE VALVES

THE WM. POWELL COMPANY CINCINNATI 22, OHIO





## "Quote ... End Quote"

#### Contractors vs. Engineers

"Minnesota contractors last month countered a move by consulting engineers which they charge 'usurps' the functions of the plumbing and heating contractor . . .

The contractor group adopted a resolution charging consulting engineers in the state with taking advantage of an obscure and obsolete statute in order to force employment of an engineer to design, plan, and supervise installations made by the contractor. The association called for amendment of state law to allow individuals, partnerships, or corporations to hire or not to hire as they may choose, the services of a consulting engineer to design, plan, and supervise their plumbing work." - Plumbing and Heating Business, March 1961.

#### **Turnkey Contracts**

"Another example — buyers, sellers, and consultants in our industry are faced with the dubious assets and distinct liabilities of turnkey contracts (wherein equipment manufacturers become consultant-constructors) . . . particularly in respect to the deleterious effects on long established and mutually beneficial direct relationships between

smaller suppliers and the operators." — Wm. F. Crawford to the opening session of the American Power Conference, March 21, 1961.

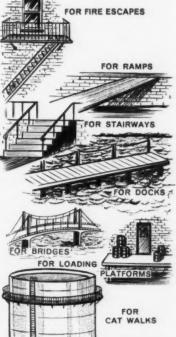
#### Men of Distinction

"Lord Calvert salutes the engineers of America, whose skill and creative ability personify The American Quality of Greatness." — an advertisement complete with picture of the Golden Gate Bridge in *The New York Times*, April 12, 1961, and several later issues.

#### **Contractors Need Consultants**

"Apropos of his article, "The Practice of Engineering,' that appears in this issue of The Bulletin, Raymond Mirrer, who is a P.E. and a member of the New York Bar on his own right as well as president of the Brooklyn Engineers' Club, made quite a few interesting observations over a luncheon we had with him the other day. Just as Liz Taylor had a battery of specialized physicians during her siege of pneumonia, so, too, just as general contractors need several types of professional engineers for consultation, it is sometimes wise to engage another consultant on a specific problem to justify your judgment and plan of operation. Mr.





#### NON-SLIP SAFETY WET OR DRY

Simply apply epoxy resin to a clean surface . . . cement, wood, metal, ceramic tile . . . then sprinkle Exolon on the surface before the epoxy hardens.

EXOLON Anti-Slip is a low cost electric furnace grain that imparts hardness and wear resistance to any surface. Never polishes smooth in the heaviest traffic.

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#### TANK CONTENTS AT-A-GLANCE with Dial-Type Liquidometer Gauges



For added assurance of accurate liquid quantity record keeping, specify easy-toread Liquidometer gauges. Positive dialand-pointer type indicators help to prevent erroneous readings . . . speed record keeping by showing tank contents at-a-glance.

Liquidometer gauges are available to measure and indicate virtually any liquid - at the tank site or remotely. Also available: integral or separate liquid level switches for automatic level warning or control. Float, hydrostatic, electric, or electronic operation can be supplied to meet your specific needs. Let Liquidometer's forty years of experience in liquid level gauging and control work



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for you. Write for latest literature.

Mirrer does not berate his profession with this suggestion. He does want to point out, however, that they are human and that their judgment, therefore, is not always infallible. Several jobs come into mind where consultants have agreed with other consultants with unexpected embarrassing results. Nevertheless, considering the thousands upon thousands of jobs on which they are called upon for their approval year after year, the faults have been few and isolated. The consulting engineers are worth their call." - The Bulletin, March 1961 issue.

#### Good Firm - Bad Publicity!

"Trust promoters are striving desperately to look good just before the election Tuesday, but not even they claim to have called for any bidding on the Atoka pipeline engineering contracts.

This lush contract was handed to the E. C. Bretz engineering firm on a silver platter. Bretz was hired by the trust promoters even before the rubber-stamp city council acted on any phase of the trust.

"The result? So far, Bretz has been paid a total of \$1,086,328.41 in engineering and planning fees. The project is barely started.

"Trust promoters say it is awfully hard to take bids on things like engineering services. Yet the Federal government does on major projects, and so do prudent private citizens.

"Had bids been taken, it is not likely the Bretz firm would already have been paid more than a million dollars in fees." - from a handbill widely distributed in Oklahoma City, by Bill Kessler, candidate for Councilman - Ward 1.

#### The Water Resource Problem

"Cleaning the nation's water is a political challenge that arouses implacable resistance. St. Joseph [Missouri] was taken to court only after many conferences, warnings, and a hearing. Throughout the hearing, a transcript of which ran



COMPACT, HERMETIC CENTRIFUGAL—A 130-ton Turbopak is only 14' long, 5' deep and  $6\frac{3}{4}$ ' high, nearly 50% smaller than previous designs. Exclusive Borg-Warner power transmission reduces compressor rotor size to gain space-saving compactness.

COMPLETELY FACTORY PACKAGED—To cut installation costs, the Turbopak is completely factory assembled, insulated, piped, wired, charged, tested. It's shipped and rigged as a single unit—no assembly or refrigeration piping on the job.

AUTOMATIC CAPACITY CONTROL—Pre-rotation vanes provide efficient capacity reduction to 5% of full load. This continuously variable control matches compressor capacity to air conditioning load, assuring maximum system performance.

ULTRA-QUIET OPERATION—Runs more quietly than water pumps that supply it. Quiet, vibration-free operation permits location anywhere. "Pushbutton" controlled from convenient electronic control center. 65 tons refrigeration and up.



Another YORK Trail Blazer Concept Proved in Action at Insurance Company of North America, Richmond, Indiana—A 125-hp York Hermetic Turbopak supplies chilled water to air condition this modernized office building. Cool, clean, debumidified air greatly increases the comfort and efficiency of the employees.



Air Conditioning, Heating, Refrigeration and Ice-Making Equipment • Products for Home, Commercial and Industrial Applications



# Now Plastic Piping to handle Hot, corrosive fluids and gases

Corrosion is expensive. It increases operating costs. It requires additional maintenance and reduces plant operating efficiency. And, previously, as the temperature of the fluids or gases being handled increased, expensive alloy and non-metallic piping systems were required.

Now, at costs substantially lower than other comparable materials, "Penton"\* (chlorinated polyether) piping systems handle corrosive fluids and gases at temperatures up to 250°F. This new polymer is extremely resistant to thermal degradation at elevated temperatures, retaining high strength characteristics over a broad range of temperatures. It is essentially unaffected by either inorganic or organic agents, including aromatic hydrocarbons. This outstanding resistance to corrosive attack, coupled with its high degree of dimensional stability at elevated temperatures enables "Penton" piping systems to handle chemicals that even metals cannot.

Widely varying conditions including temperature, pressure and concentrations of fluids or gases being handled require each proposed piping system to be carefully selected. Should any questions arise, Tube Turns Plastics' engineers will be happy to consult with you on your corrosion problems. For additional information, call or write today.

#### TUBE TURNS PLASTICS, INC.

30th and Magazine Street, Louisville 11, Kentucky

Mark of progress in industrial plastics piping

For quick, easy joining of "Penton" pipe,



"'tlp" and "THERMO-SEAL" are trademarks of Tube Turns Plastics, Inc.

For quick, easy joining of "Penton" pipe, fittings and valves, the new THERMO-SEAL\* heat tool produces permanent, leakproof joints that are stronger than the pipe itself. By placing the units to be joined on the tool, heating and then assembling, the joint is completed and ready for use in a matter of seconds. See it in action. Consult your nearby Tube Turns Plastics distributor today.

to 426 pages, the city's attorney spoke of the 'alleged' pollution despite clear evidence that untreated sewage from 80,000 people was being dumped into the [Missouri] river every day.

"Much of the foot dragging by

"Much of the foot dragging by municipalities can be explained by an axiom of local politics: building a water treatment plant to clean up the water used by voting citizens is almost always easy to accomplish; however, a sewage plant that will treat a community's wastes benefits only the neighboring communities downstream. A Public Health Service official says that he detects a slow change in this selfish attitude, in part because of the growing popularity of water sports, which need clean water, and also in part because . . . 'almost all cities are downstream from at least one other city."

"In contrast, the resistance of industry to enforcement action is growing, even though many manufacturing plants cannot use poltuted waters. By 1980, industry will need nearly twice as much water as agriculture and all municipalities combined. And the nation's industries are by far the worst polluters, dumping twice as much waste as the municipalities.

Spokesmen for industry do not deny that industrial pollution is a critical problem, but they claim that their research program will lead to improvement. Leonard Pasek, an executive of Kimberly-Clark Corporation, told a Senate committee that the National Council for Stream Improvement, which is financed primarily by pulp and paper companies, has a research budget of several million dollars a year. In many cases, competitive pricing makes the cost of building sewage treatment plants prohibitive. An executive of a plant that produces soda ash said during a Public Health Service conference that forcing his company to install treatment facilities would drive production costs so high that his plant would close down because it

"'Penton" is a trademark of Hercules Powder Co.

## New CROUSE/HINDS



Designed to maintain operating position and thermal level essential for proper self-cleaning of iodine-cycle lamps, QUARTZ-beam QFL-15 projects per-unit-area maximum of lamp's 33,000 lumen output. Provides constant unfading output of clean, white light, with candlepowers up to 200,000, and an average lamp life of 2,000 hours.

Three beam spreads available, with minimum vertical angle as narrow as 13°. Reflector is one piece dieformed, polished or etched. Cast aluminum door and housing sealed by silicone rubber gasket. Heat and impact resisting lens. Door locks tightly and releases quickly by means of 4 wing-nut clamps.

External raintight fuseholder (with fuse). Aiming and leveling device, exterior focusing screws included. Trunnion or slip fitter mounting. Hood, louvers and special mounting bases available. Get further information from your Crouse-Hinds distributor.



## **Protective Coating Inspection Problems?**

Here's Your Answer

No matter whether you're coating a pipeline or a chemical tank, continuity is vital. Use of a Tinker and Rasor Holiday Detector while the job is open, can save days of downtime later on.

#### PLANT AND YARDS



Tinker and Rasor EPAC Holiday Detector or J-1ACM

EPAC operates off 110 volts A.C. power for stationary coating operations. Internal voltage adjustment from 5,000 to 20,000 volts or with external variable transformer from 500 to 6,000 volts, or 5 KV to 20 KV.

J-1ACM for continuous inspection on coating and wrapping machines which use water

#### PIPE



Tinker and Raso E-P or E-4 Holiday Detectors

Output adjustable from 5,000 to 20,000 pulsating voltage.

E-P-All purpose for larger diameter pipe, damp or dry climate, pre-fab film or hot applied coatings.

E-4 - Lower cost, dry surface type of demeter pipe and flat surfaces.



THIN FILM

Tinker and Rasor M-1 Holiday Detector

For painted or sprayed thin film coatings such as vinyls and epoxies. Maximum applied voltage 67½ V., non-destructive to coatings Belt mounted, 4-lbs. total weight.

#### UNDERGROUND





Tinker and Rasor Pearson-type Holiday Detector

For detecting holidays and electrical shorts without uncovering the pipeline. Completely transistorized . . . generates 15 watt, 750 cycle, stable A.C. Audio-frequency signal. Adaptable to null search method.



Tinker and Rasor has prepared a complete data kit which describes the null search system as well as other recommended procedures for inspecting protective coatings. Material includes technical data on equipment, general discussion of types of detectors, theory of operations, etc.

#### **Engineering Note:**

To insure a perfect application, include Tinker and Rasor Holiday Inspection. Write for specification guide.

Quality Control for Coating Application

## TINKER & RASOR

213 Agostino Road, P.O. Box 281 . San Gabriel, California

would be unable to compete with the other nine soda ash producers." - William L. Rivers in The Reporter. March 30, 1961.

#### The Highway is the Free Way

"Because of the individual freedom and opportunity that the automobile provides, when we have good highways, I expect that automobiles are here to stay, that their use will continue to increase, and that we will continue to improve our highways to accommodate them. We have problems in our fast changing times, and we have many stresses and strains brought about by our economic growth and our social adjustments. Many of these problems are too often unjustly blamed onto our automotive society, mainly because we are so far behind with our highways.

"I expect continuation of the Interstate System on schedule, and in our larger urban areas I anticipate a considerable expansion of the expressways over and beyond that provided by the Interstate. The Wilbur Smith Study previously mentioned suggests that in addition to the present 6700 miles of urban Interstate, and the 800 miles of existing urban freeways other than Interstate, further development of 5600 miles of urban freeways will be needed by 1980 to serve the traffic, and I believe this will be obtained.

"Basic geometric design of our freeways is not expected to change much; possibly a minor amount of refinement as experience dictates. Generally, experience to date indicates our concepts are sound. Improvements will be made in materials and construction methods. I do not foresee anything radical.

"I do expect to see great progress made in developing the over-all potential of existing streets and highways and transit facilities. supplemented with freeways, to form an integrated over-all transportation system. This will require increasing concentration of effort for spot improvement, both in urban



## FULLER PNEUMATIC CONVEYING SYSTEMS INCREASE PRODUCTION, CUT CONTAMINATION FOR GOODYEAR

Recent installation of specially engineered Fuller Airveyor® pneumatic conveying systems to handle pelletized rubber has helped Goodyear Tire and Rubber Company increase production. These systems are the latest Fuller design resulting from over 15 years experience in pneumatic conveying of rubber pellets. These completely enclosed automatic systems virtually eliminate contamination problems and greatly reduce the chance of loss due to spoilage.

Automated handling of crude rubber with Fuller Pneumatic Conveying Systems, in place of conventional rubber slab sheeting on a mill, is the key. One Airveyor system conveys the pelletized rubber from the pelletizer to a weigh station, a distance of 500 feet. Four more systems operate from the sink dump scales to inlet spouts of the finish-run Banburys.

All of these Airveyor pneumatic conveyors are of the vacuum type, employing positive pressure exhausters for air supply. Each conveying system is equipped with its own individual bag-type filter, automatic in operation, which provides for 100% visible dust retention. Exhausters and filters are located on the roof. A control panel permits manual or automatic operation of the entire handling system.

If you are handling dry, bulk, granular materials, a Fuller Conveying System application-engineered to your process can be equally advantageous. Look to Fuller, whose range of products coupled with experienced know-how offers you the best single source for solving pneumatic materials handling problems. Just call or write Fuller today outlining your problem—no obligation, of course.

A-216

"See Chemical Engineering Catalog for details and specifications."



#### **FULLER COMPANY**

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Subsidiary of General American Transportation Corporation
Offices in Principal Cities Throughout the World



and rural areas. We have developed scientific methods of defining bottlenecks and weighing economic advantages of different solutions. In our urban areas we cannot afford to make every traffic corridor a superhighway, but we can do a great deal toward making modified expressways out of city thoroughfares. This will take careful timing." — remarks by Ellis L. Armstrong, F ASCE, at the Highway Division of the American Socitey of

Civil Engineers session during the National Convention, Phoenix, Arizona, April 11, 1961.

#### Same Old Pattern

"As expected, the House Ways and Means Committee hearings on the Presidents' eminently sensible proposals for financing the Federal interstate highway program have begun on the same note of divisive opposition which has characterized this legislation in the past.

"The principle at issue, as enunciated by President Kennedy this year, and by President Eisenhower before him, is simply that these massively expensive highways should be paid for by the people who use them. Mr. Kennedy suggests that the necessary additional Federal aid funds come either from higher fuel taxes on truckers, who are not now paying their fair share, or by a motor fuel tax of 4½ cents a gallon on all motorists. (The current 4-cent gas tax will be reduced one penny on June 30 unless Congress prevents it.) Either of these proposals is fair. Either would preserve the integrity of the original concept of the program. Either would assure a continuing flow of adequate funds, on a pay-as-you-go basis.

Perhaps the most alarming new idea, tossed out by Representative Curtis, of Missouri, is that the current level of Federal aid is too high - that instead of 90 percent of the cost of the system, the Federal aid percentage might be dropped to the neighborhood of 70 percent. But this most certainly would slow the construction of the interstate system to a crawl, and very well might insure that it never would be completed. In terms of mileage, the interstate system is not awe-inspiring; indeed, it constitutes only about 1.2 percent of the nation's highway network. When completed, however, it will carry an estimated 20 percent of all United States traffic and this, ... is what makes it important.

"Rather than curtailment, however, the major effort in opposition to the Kennedy program is developing around the diversion of tax revenues from the General Fund of the Treasury to highway purposes. The theory of this is that highway users already are paying their fair share, and that something also should be paid by indirect beneficiaries of new freeways. As we see it, there are three faults in this reasoning: First, such a diversion would create a further deficit



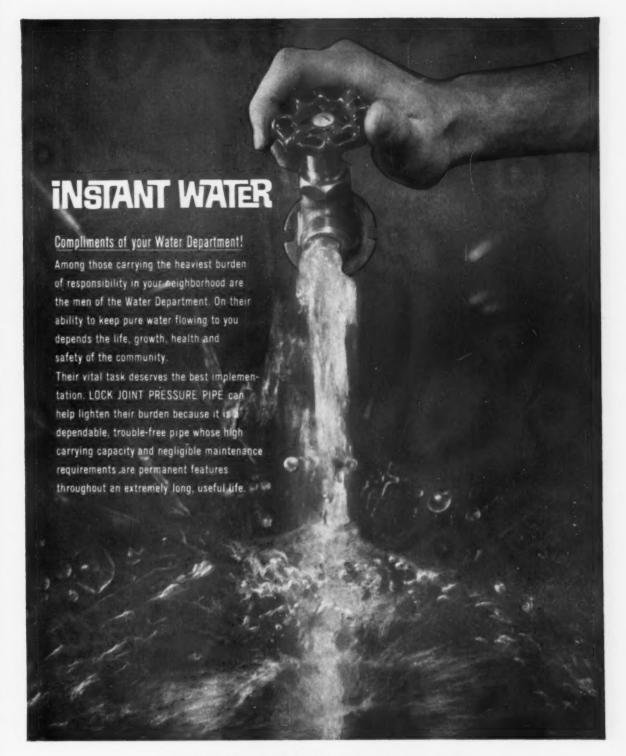
It's easier to operate a G-A Flowtrol Valve than it is to drive a car with power steering! The reason? Line pressure furnishes the power to open or close the valves. No manual effort, no handwheels, no motors, no levers are needed—regardless of size of valve or pressure. Just a "flick of the wrist" or press of a button will fully open or tightly close the valve.

Get all the facts in Bulletins W-8A and G-4.



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in the Federal budget, where none need occur. Second, 'indirect benefits,' while undoubtedly they exist, are impossible to assess. And third, those who stand to gain the most from the new freeways are motorists themselves. On the latter point, Maj. Gen. Louis W. Prentiss, executive vice president of the American Road Builders' Association, had this to say in his testimony before the House committee: 'At the present time, only 12 cents of the average motorist's transportation dollar is allocated to paying for the highways on which he drives. All of the evidence indicates that his total transportation costs will be reduced if a somewhat larger percentage is used to provide better highway facilities. The average motorist is now paying the equivalent of a 20-cent-per-gallon tax in accident costs; he is paying it to insurance companies, body repair shops, hospitals, and mortuaries, and it is a

costs that can be reduced . . . In our judgment, the motorist will reap a net savings despite the increased levy." - The Evening Star, Washington, D. C., March 26, 1961.

#### That's Where Our Money Goes

"The House Foreign Affairs committee has released a report critical of a \$65 million camp built for the Pakistan army with U.S. money.

"The report, wryly humorous in tone, was prepared by committee investigators. . . . the camp, built to house the First Pakistan armored division, contained:

Frilly bathroom fixtures for soldiers who rarely shave themselves. Hot water systems that are untrusted . . . they are not understood. Walk-in refrigerators for meat that is daily slaughtered, cooked, and eaten on the spot.

"Committee investigators said the camp cost more than originally planned.

They were critical, also, of its location - smack against the Indian border but separated by two major rivers and miles of rough terrain from the northwest frontier where the danger of a Soviet attack appears to be greatest.

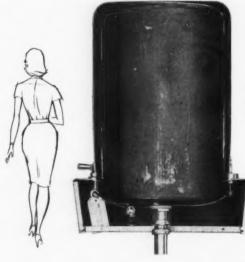
The report blamed some of the extravagance on a . . . military missionary zeal to change Pakistani 'hygenic and dietary habits.'

The investigators said the military planners overlooked Moslem religious practices favoring killing animals the day they are eaten.

"The problem involved could not be solved merely by providing refrigeration, the report said.

"As for the fancy shaving arrangements, the investigators found the task is done not by the soldiers themselves . . . but during the siesta hour by a camp follower . . .

"In overhauling Defense Department objections that publications of the report might offend Pakistan, the committee said the country was a staunch ally and its armed forces deserve high ratings in zeal and capability." - Associated Press.



This is the back of Haws drinking fountain model 73

# Look at the Back for a change!

Even our competitors' fountains look good from the front, but Haws models back up their good looks! This semi-recessed Model 73, for instance, is a beauty in 18 gauge, 304 stainless steel - and the craftsmanship goes all the way around! Careful quality is the standard at Haws - even on features you can't see. This fountain gives you automatic stream control; even has its head locked to the bowl for vandal-proof service.

And let's face it!

This handsome Model 73 adds built-in class to hallways, lobbies - anywhere you choose to specify its beauty. You can't miss! Write for Haws comprehensive 1961 catalog and see. Write now!



Since 1909



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Size 1 combination starter with fused disconnect switch



Size 1 combination starter with circuit breaker



BULLETIN 705 Size 2 across-the-line reversing starter with overload relays



Size 1 reversing starter with fused disconnect switch



BULLETIN 715
Size 1 across-the-line,
multi-speed starter with
overload relays



Size 2 multi-speed starter with circuit breaker



BULLETIN 702
Size 3 three-pole, a-c solenoid contactor



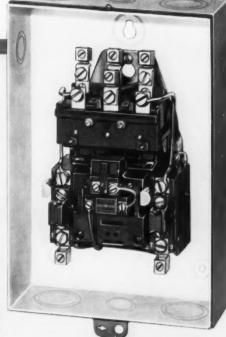
Pygmies in Size Giants in Performance-

## the NEW Allen-Bradley Across-the-Line Starters!

This new line of across-the-line motor starters is the result of over 30 years of experience and leadership in the motor control field.

While retaining the simple solenoid principle—with only ONE moving part—these starters are completely new in every way. They are amazingly small in size—yet test after test has proved they will not only outperform but also outlast any starter now on the market. They are good for many millions of trouble free operations. All have scores of design refinements that make them easier to install and maintain. All are available in the smart new enclosures designed by Brooks Stevens. They make a beautiful addition to any machine or control installation.

You'll want to get the complete story about these truly revolutionary new across-the-line starters. Write for new Publication 6100.



#### **BULLETIN 709**

This popular across-the-line solenoid starter shows the new Size 2 construction. Note the white interior and generous wiring space. Bulletin 709 starters are available, in the new construction, in seven sizes—Sizes 00 to 5, with a maximum rating of 100 hp, 220 v; 200 hp, 440-550 v.

11-61-80

ALLEN-BRADLEY

Member of NEMA

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.

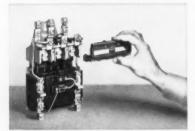
QUALITY MOTOR CONTROL

# Features of the NEW Allen-Bradley starter line that are of value to you!

Every detail of the new Allen-Bradley motor starters has been designed to help make this the best line of motor control on the market. Remarkably small in size, each starter is a giant in performance. Being light in weight, these starters are easy to handle and a cinch to install. The generous wiring space, full front wiring, white interiors, and convenient knockouts make installation easy. The enclosure cover is firmly held with a quarter-turn fastener. All installation, inspection, and maintenance operations can be handled from the front—as shown in the illustrations below—without the use of special tools.



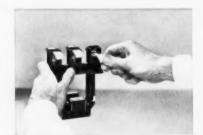
New Bulletin 709 Size 3 acrossthe-line motor starter. Note the generous space for wiring, accessible terminals, and white interior.



QUICK, EASY CONTACT INSPECTION— When the arc hood front cover is removed by loosening two captive screws, contacts are plainly visible from the front.



CONTACT POSITION INDICATED—Two slots in the coil cover show the position of the movable contact support—tell whether contacts are "closed" or "open."



CONTACTS EASILY REPLACED—Depress the spring slightly, and the movable contacts can be lifted out of the molded support and the new contacts slipped in.



COIL EASILY CHANGED—When the coil cover is removed, coil and magnet yoke can be lifted out from the front. They are impossible to replace incorrectly.



AUXILIARY CONTACTS EASILY ADDED to the front of the starter. Two extra auxiliaries can be added to Sizes 0, 1, and 2 starters, and four, to Sizes 3, 4, and 5.



A THIRD OVERLOAD RELAY CAN BE EASILY ADDED in the field, from the front of the starter. And the only tool needed is a common screwdriver.

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QUALITY MOTOR CONTROL



## Heard Around Headquarters

MARJORIE ODEN

Eastern Editor

#### Architects vs. Engineers

Engineers would do well to take a look at revisions that currently are being proposed for the architects' registration law in Ohio.

The new version would omit the paragraph that states: "[these sections] shall not prevent persons other than architects from filing application for building permits or obtaining such permits . . . "

If passed without this clause, the bill could be interpreted to mean that engineers could not get building permits.

And in Maine, the Supreme Judicial Court has held that an engineer cannot use the term "Engineer and Architect." The judges ruled that "the law forbids the assumption of the title of practicing architect by one who is not qualified by state registration, although he is a professional engineer. But the latter may, nevertheless, engage in architecture to the contained extent that such is incidental only to his engineering.

"Professional engineering and architecture in the Legislative estimation are patently regarded as separate *species* of the engineering *genus* and such a judgment seems objectively valid. While categorically an engineer, the architect — without disparagement toward the professional engineer — is required to demonstrate that he possesses and utilizes a particular talent in

his engineering, to wit, art or aesthetics, not only theoretically but practically, also, in coordination with basic engineering. R. S. C.81 prescribes that an engineer verify that he has such special talent to a sufficiently cultivated degree before he may publicly solicit patronage as an architect.

"We conclude that, while all architects may be engineers, all engineers are not architects."

#### World's Fair

Time is running short for exhibitors at the 1964 World's Fair in New York City. Brigadier General William Whipple, Jr., head of the Fair Corporation, explained that every attempt is being made to get utilities, telephones, and roads completed this summer. That will leave only two construction seasons before the Fair's opening, and if many exhibitors wait until 1963 to start construction, there could be a serious shortage of skilled labor.

Consultants could use this as a selling point to prospective exhibitors who are dragging their feet.

Both labor and management in the New York City building industry have realized the importance of spreading the work load. An unusual document recently was presented to Fair officials — both labor and management signed a voluntary agreement that there will be no "lockouts, strikes, picketing, or interference with the progress of





## ...the most *practical* method of luminaire maintenance!

Relamping alone cannot maintain peak lighting efficiency! Dirty luminaires waste money as well as foot-candles. But vitally necessary periodic washing . . . under most serving methods . . . involves almost prohibitive cost and hazard to personnel.

Thompson Hangers reduce servicing costs and eliminate all climbing and electrical dangers automatically. They permit one unskilled man... without assistance or special auxiliary equipment or personal hazard... to service a fixture within a few minutes at floor level. And that's why Thompson Hangers are the fastest, safest and

most economical method of maintaining peak lighting efficiency at minimum cost.



FOR DETAILS, WRITE FOR BROCHURE TH-57

THE THOMPSON ELECTRIC COMPANY
P.O. Box 873-B Cleveland 22, Ohio

construction and building at the Fair site." Since the electricians' contracts are up for renewal in 1962 and all other building labor will get new contracts in 1963, chances were good for a disagreement or strike.

Many industrial exhibitors and a majority of the foreign exhibitors have not yet selected architects or engineers.

Possible foreign clients, all of whom probably will use U. S. consultants, are: Cameroon, Central African Republic, Chad, Colombia, Republic of Congo (Brazzaville), Ecuador, Gabon, India, Indonesia, Iran, Ireland, Japan, Jordan, Korea, Malaya, Mali, Morocco, Nepal, Peru, Philippines, Spain, and Tunisia. The Organization of American States also has announced plans for exhibit space.

Previously announced exhibitors (still potential clients in many instances) are: Argentina, Bulgaria, Chile, China (Nationalist), Israel, Mexico, Uruguay, U.S.S.R., and the Vatican.

Included in earlier listings, but not now planning to exhibit, were Italy and Paraguay.

In the industrial area, roughly half of the available space has been let. Major change is that the 50,000 sq ft maximum per exhibitor has been lifted. Several exhibitors, such as American Telephone & Telegraph with 150,000 sq ft, will have considerably larger buildings than were planned originally.

The transportation section, which is under the auspices of the New York Port Authority, is being handled exactly the same as the industrial area. The exhibitors will select their own architects and engineers, and plans will be submitted to the Port Authority for final approval.

A "village area," planned earlier to allow small exhibitors to take less than the usual space minimum, has been discontinued. This gives the consultants another area for potential clients: trade associations and groups of similar businesses





## SUBMERSIBLE PUMPS

deliver water

economically

consistently

silently

efficiently

The Layne Submersible Pump installation gives you noise free operation because the pump and motor are completely submerged. The Layne Submersible is adaptable to all wells; requires a minimum of space since no pump house is required; eliminates possibility of water contamination; and eliminates the opportunity for vandalism or other accidental mishap or damage.

Layne Submersible Pumps are available for wells as small as 6 inches and in capacities from 30 GPM up. For additional information write for free bulletin number 202.

The Layne In-Line Submersible pump provides the answer to many problems in booster pump applications. The pump operates as an integral part of the line and is designed for use by municipalities, industry, such as petroleum and chemical plants and by agriculture. Advantages include: simple installation, no additional space required, continuous service even under flood conditions, and no possibility of surface water contamination.

Layne In-Line pumps are made as small as 4 inch bowls on a 4 inch motor for use in a 6 inch pipe to deliver 30 GPM. Larger sizes are available as required. For additional information write for free bulletin number 203.



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# Lovejoy Precision-Made Industrial UNIVERSAL JOINTS



Standard and Heavy Duty Single Joints—Type D



**Booted Joints** 

FOR APPLICATIONS
UP TO 1750 RPM.



Standard Double Joints—Type DD

This high quality line of universal joints is available in a wide range of sizes and types for all industrial applications...

- 10 to 250 hp. at 100 rpm.
- Standard joints operate at speeds to 1500 rpm., heavy duty to over 1750 rpm.
- Single joints operate through full 40° working angle, double joints 80°
- Boot provides effective means for proper lubrication...eliminates dust...
   can be removed in field

Ask for recommendations on your application. Request Catalog D-61 and prices.



Lovejoy specializes in a full line of easily installed, maintenance-free power transmission equipment:



FLEXIBLE COUPLINGS any size or type, including specials, .003 to over 8500 hp. Request Catalog A-61.



VARIABLE SPEED PULLEYS—¼ to 25 hp., ratios up to 4 to 1. Request Catalog B-61.



VARIABLE SPEED BELTS
—complete line of types
and sizes for all applications. Request Catalog
C-61.

Motor Bases Take
Shaft Mounted Gear Reducers Variable Sp

Take-Up Frames
Variable Speed Transmissions

Write or phone for literature and prices. If you have a specific requirement or problem ask for recommendations. No obligation.

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who now will be allowed to combine forces for space in the industrial area.

Transportation for the Fair still is a source of considerable curiosity, and no contracts have been signed yet. However, General Whipple said he hopes for a final decision this month. Among the internal transportation methods being considered is a miniature railroad, designed by a Punch cartoonist. "Explaining this proposal in engineering terms would be like trying to describe a painting with mathematics. It looks more like something from Alice in Wonderland than anything else," Whipple added. The primary problem in selecting internal transportation will be getting something that will work well with buses, trains, and autos running to the Fair. The streets have been designed wide enough to allow monorail, or any other transportation proposed to date.

#### U. S.-Canadian Committee

The first meeting of the Committee on United States-Canadian Consulting Relations was held recently in Detroit, with representatives from the Association of Consulting Engineers of Canada and Consulting Engineers Council. The goal of the committee is to foster joint action and to help build up international cooperation among consulting engineers.

The first items of discussion were the relative organizational frameworks of the two groups. The primary difference between them at present is that CEC is composed of state and regional organizations, while ACEC is composed of individual members. However, ACEC is in the process of converting to organizational membership. Another difference is in the membership requirements. ACEC is more difficult to join, requiring a minimum age of 35 and at least five years experience as an independent consulting engineer.

The major point for discussion was the mutual problem of gov-



New Home Office of Battenfeld Grease and Oil Corporation, Inc., Kansas City, Mo., internationally known makers of custom lubricating products and waterproofing materials. Air-conditioned by Arkla Gas Absorption system. Architects: Monroe & Lefebvre. General Contractor: Bennett Construction Company.

### Get low-cost heating and cooling! Specify GAS and ARKLA

After considering first cost, fuel cost and over-all operating cost, the Battenfeld Grease and Oil Corporation specified Arkla year 'round gas air condi-

tioning. Their trouble-free gas absorption system practically runs itself.

Low pressure steam from a gas-fired boiler energizes the 25-ton Arkla Water Chiller, which automatically modulates to meet varying loads. Boiler capacity is put to use the year 'round... cooling in summer, heating in winter.

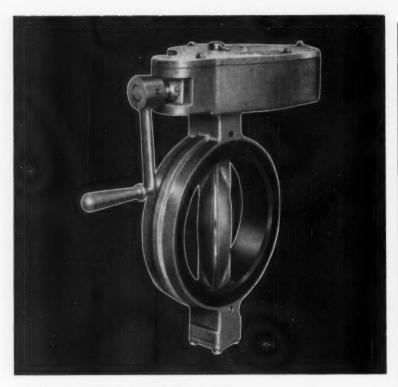
Operation is quiet and frictionless, with no major moving parts. And the fuel is clean, fast, safe, dependable, economical gas.

For trouble-free, low cost, year 'round air conditioning, specify gas and Arkla. Call your local gas company or write to Arkla Air Conditioning Corporation, General Sales Office, 812 Main St., Little Rock, Ark. American Gas Association

FOR HEATING & COOLING GAS IS GOOD BUSINESS!



Arkla 25-ton gas absorption unit. Low operating costs. Fully automatic. Packaged construction. Easy installation. Long dependable service.



## Monoflange Mark II... provides 5 important advantages

The increasing popularity of the Monoflange Mark II rubber seat butterfly valve indicates that Consulting Engineers are rapidly becoming aware of the advantages of this type of equipment.

- No other type of valve requires so little "space." Face-to-face dimension on a 12" valve is only 3½".
- No other valve is so easy to install. Merely slide between two pipe flanges and tighten up. No gaskets are required.
- No other valve is so easy to operate. Disc seats in rubber—no metal-to-metal "wedging." Great savings in operator cost.
- No other valve is so "tight" after continued use. Many years of the most difficult service has proven that rubber seats are unmatched for leak-proof service.
- No other valve is so maintenance-free.
   The rubber seat of the Monoflange Mark II is designed to last for the life of the valve.

Sizes 3" through 20" Operators—all types Pressures to 150 psi. For tight shut-off *and* throttling service

Monoflange MK-II
RUBBER SEAT BUTTERFLY VALVE

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319 WEST VAN BUREN STREET CHICAGO 7, ILLINOIS A most comprehensive Bulletin has been prepared especially for Consulting Engineers. All pertinent data is included—even the most up-to-date data on compressible gas flow. Write for Bulletin 10-1.

PRATT

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Engineering for
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ernment engineering. Both groups felt that much of the work now done by government bureaus could be done more economically and expeditiously by consultants. The CEC representatives, George Toman, CEC secretary; and F. Spencer Weber, chairman of the CEC Committee on U. S.-Canadian Consulting Relations, outlined their group's activities to date in combatting government engineering. The ACEC representatives, president John Ross and executive secretary Col. J. Murray Muir, presented a summation of the brief recently submitted to the Royal Commission on Government Organizations in Canada (Consulting Engineer, May 1961, page 80).

#### **Arizona Consultants Incorporate**

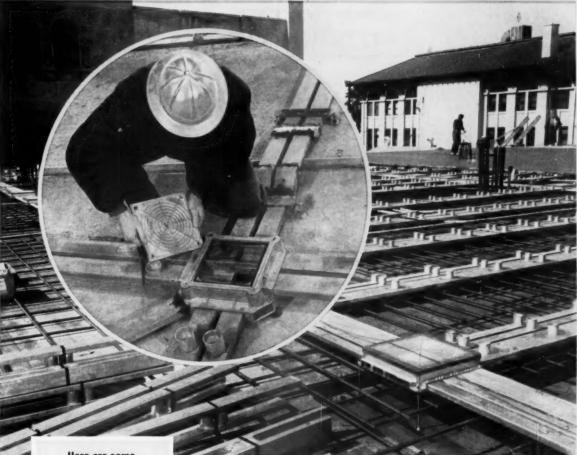
The Arizona Consulting Engineers Association, Incorporated, has filed articles of incorporation as a non-profit organization to "aquaint the general public with the work of the consulting engineer and to promote ethical and professional standards among engineers . . ." Offices of the organization will be in Phoenix. The initial board of directors includes John Girand, James Hastain, Archie Brown, Clyde Stauffer, Lloyd Miller, and James Warne, of Phoenix; and John Stufflebean, of Tucson.

#### ASCE Actions

New policies announced by the American Society of Civil Engineers board of directors at a recent convention include:

Coordinating Committee Policy
Paper — Not adopted. The board
contends ASCE already has a policy covering government vs private design of public works, and
therefore there is no need to consider the Policy Paper. Last year,
ASCE adopted a rather detailed
policy in two parts, but after due
consideration the second — and
more positive — part was dropped.
Corporate Practice — The Conditions of Practice Committee recommended limitation of corporate

## NOW IT'S SQUARE D GATEWAYDUCT



#### Here are some recent Gatewayduct installations

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Assurance Co.
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Office Buildings
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You're ahead <u>two</u> ways when you choose this superior underfloor duct for power, signal and telephone systems...

GATEWAYDUCT is now manufactured by Square D and is available exclusively through Square D distributors. This underfloor duct system has gained tremendous acceptance among electrical contractors, consulting engineers and architects because of its significant design and installation features. Now the same field service on which Square D has built its national standing is behind every Gatewayduct installation.

SQUARE D COMPANY, MERCER ROAD, LEXINGTON, KENTUCKY



#### SQUARE D COMPANY

wherever electricity is distributed and controlled

DUKANE FLEXIFONE DIAL INTERCOM

Here in one compact, smartly styled desk unit, the finest features of the telephone and the intercom are provided. Pushing a button or dialing a one or two digit number provides total communications.

#### DUKANE

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TELEPHONE SYSTEMS

... efficient, low cost internal communications for any business from 2 to 200 phones!

You'll be dollars ahead the day you install a DUKANE Private Automatic Telephone System. You'll continue to enjoy benefits through the increased efficiency of inter-office communications. Outside lines are kept free for sales producing calls, switchboard traffic congestion is reduced and toll charges and call backs are kept to a minimum. There's a **DUKANE** Private Automatic Telephone System to fit every business regardless of size.

#### CHECK THESE OUTSTANDING **DUKANE FEATURES...**

TWO DIGIT DIALING-Simplified circuits eliminate long numbers to remember, less errors, faster service.

AUTOMATIC RINGING-Just dial number, the switchboard does the rest. ABSOLUTE PRIVACY-Yours is a private line to party called. No "eavesdropping."

GROUP HUNTING-When party in called group is "busy," another phone in same group is automatically selected.

PRIORITY-Special button allows you to cut in on a busy line for urgent busi-

AMPLIFIED TELEPHONE-For hard of hearing or for areas with high ambient noise levels.

CODE CALL-Permits paging by coded bells, buzzers, etc., answer by dialing predetermined number.

DUAL PHONE-Gives you two lines. Permits holding one call to dial another

YOUR AUTHORIZED FACTORY TRAINED DUKANE ENGINEERING DISTRIBUTOR WILL BE HAPPY TO GIVE YOU FULL DETAILS & PRICE

DUKANE CORPORATION Dept. CE-61 • ST. CHARLES, ILLINOIS	WRITE FOR
NAME	
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practice to organizations having a majority of ownership held by engineers and a majority of the directors registered engineers. The board agreed, and added that the president of the group also should be a registered engineer.

¶ Surveying - A simple change of the word "surveys" to "surveying" by the National Council for State Boards of Engineering Examiners is being requested. Including the word "surveying" in the legal definition would give a state board of registration authority to recognize professional level surveying (previously defined by ASCE) as qualifying experience toward engineering registration.

¶ Advertising — Some advertising of engineering-construction firms was found to be at variance with the intent of the ASCE Code of Ethics. The firms involved will be asked for their cooperation in maintaining professional standards.

Saline Water — ASCE is in favor of progress, but against crash programs. Continued pilot plant research is advocated, but development of other sources of water was considered more realistic.

The presidential nominee, Dr. G. Brooks Earnest, suggested rating firms as to their attitude and treatment of engineers, in much the same manner that Engineers Council for Professional Development rates school curricula. Dr. Earnest. president of Fenn College in Cleveland, stressed that only registered persons should be allowed to use the title "engineer."

#### Salary Survey

The Engineering Manpower Commission salary survey shows that salary levels rose approximately five percent per year between 1958 and 1960, with the current over-all median salary now \$9600.

The survey of consulting engineers' employees (and employers who were on straight salary - any whose income was based on profits were disqualified) showed lower salaries than the over-all. However,

#### MORE PROFIT PER TON FOR YEARS TO COME!



## STEPHENS-ADAMSON Quality Engineered

Maximum conveying efficiency and profitable bulk handling over the belt depends on what's under the belt in quality-engineered conveyor components. No single component has a greater bearing on conveyor performance than the carriers, carrying the load. The combination of features you see highlighted in the cutaway view above, are available in no other carrier on the market. The result is smooth performance, simplified and reduced maintenance, longer carrier life and less handling cost per ton. STEPHENS-ADAMSON Carriers are available in a wide range of sizes in both ball and roller bearing carriers . . . stocked for immediate delivery.

#### WRITE FOR CARRIER BULLETIN 760 WRITE FOR PULLEY BULLETIN 558



STANDARD PRODUCTS DIVISION STEPHENS-ADAMSON MFG. CO.

GENERAL OFFICE & MAIN PLANT, 23 RIDGEWAY AVENUE, AURORA, ILLINOIS

PLANTS LOCATED IN: LOS ANGELES, CALIFORNIA . CLARKSDALE, MISSISSIPPI BELLEVILLE, ONTARIO



20° Ball Bearing Carriers—designed for years of service under rugged operating conditions.



for use under loading spouts in belt or shuttle conveyors, or feeders to cushion the lumps.



-S-A exclusive CURVE CROWN PULLEY design and SQUEEZE-LOCK HUB assure maximum belt training effect, gripping power for full torque transmission, minimum belt stretch and wear.

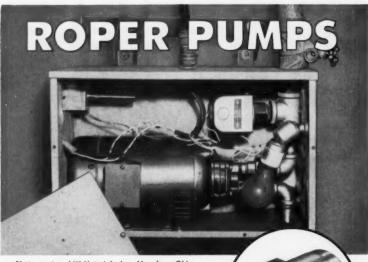


Photo courtesy J-W Materials, Inc., Napoleon, Ohio

SERIES T MODEL 3TL-348

# deliver liquid water-reducing admixture for concrete

CAPACITY 0.3-55 GPM • PRESSURES TO 400 PSI

Roper Series T pumps are used exclusively on concrete admixture dispensers Model WR and Model AE manufactured by J-W Materials, Inc. Timer controlled unit delivers measured amounts of liquid concrete admixtures, such as air-entraining and water-reducing agents. The unit handles suction lifts of up to 6' and transfers material vertically about 50' at pressures of 25 psi. Flow switch indicates if pump is running dry and by-pass valve permits easy, convenient draining of pump. Dispenser illustrated includes thermo-switch and heat bulb for protection against freezing. There is a choice of many models of the compact, easy-to-install Series T pump for use in hydraulic, pressure feed, and general transfer work pumping clean liquids up to 200 SSU viscosity.

#### Compact, Rugged, Efficient Qualities

- PUMPING GEARS operate in axial hydraulic balance. Driven gear is mounted on motor shaft, eliminating couplings.
- BEARING in backplate is heavy-duty bronze; assures proper alignment of driving and pumping gears.
- SEAL on drive shaft is either lip or mechanical. Counter-clockwise rotation is standard.
- BACKPLATE is single piece, forming end bell of motor, reducing installation

For information about your specific pump needs contact your nearest Roper dealer Send for "How to Solve Pumping Problems" booklet

ROPER
HYDRAULICS, INC.

Dependable pumps since 1857

COMMERCE, GEORGIA

the top decile of consultants' employees earn more than the average for higher paid employees.

Consultants' salaries ranged from \$5425 for a recent graduate, to over \$25,000 for an engineer who graduated before 1925.

#### **ASEE Vote**

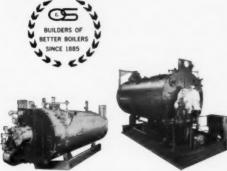
The American Society for Engineering Education voted a qualified "Yes" for the proposed merger of Engineers Joint Council and the Engineers Council for Professional Development. Most of the qualifications concerned the mechanics of carrying out the merger. So the question is still undecided.

#### **Package Plants**

The pros and cons of package plants were the topic of a recent meeting of the Association of Consulting Chemists and Chemical Engineers. Since the speakers were from Scientific Design Company and from The Lummus Company, the package plant did quite well.

Alfred R. Smith, assistant vice president of Scientific Design, defined a package plant as "a plant that we've built at least one of before . . . The incentive to the engineering company (of package plants) is obvious - royalty income, which increases profit margins and which, if adequately elaborated, lends a most desirable measure of stability to an otherwise precariously cyclic business. A supporting incentive is the fact that, in general, an engineering company contains a higher concentration of higher-grade and broader-gauge technical talent than a manufacturing company, and thereby invites its full exploitation . . . Some of the more obvious rules of thumb are (1) to avoid as much as possible areas of competitive research by other organizations; (2) to select a limited field of technical approach for the major research effort, but a field with a broad market potential. This develops expertness and yields a cumulative benefit. Shotgun-type research programs





#### . . . why it's important to packaged boiler buyers

Before you buy any boiler, look for engineering extras that can mean real money to you.

For example, one of the many extra values of the *Powermaster* is its exclusive 5 to 1 turndown. This wide range of infinitely variable firing control allows you to operate with high efficiency even where loads vary widely.

This exclusive feature eliminates waste of fuel in low or high operating ranges. You get impressive fuel savings that will repay the cost of your boiler many times in its long and productive life.

Powermaster gives you more engineering extras than any other packaged boiler made. Why settle for less? Call your nearest O&S representative today or write for Bulletin 1260.

#### ORR & SEMBOWER, INC.

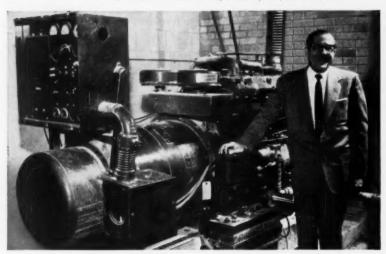
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Reading. Pa. . Since 1885

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PACKAGED AUTOMATIC BOILERS

★ A. R. Voelker, superintendent of maintenance for H. C. Prange Co., with Kohler Model 75R78, 75 KW, 120/208 volt AC.



#### KOHLER ELECTRIC PLANT



poised to prevent power failure hazards at H.C.Prange Co. store



Business as usual can continue in the H. C. Prange store at Appleton, Wisconsin, when a storm or accident causes a power blackout. A 75 KW Kohler electric plant will provide immediate emergency power for lighting, automatic heat—forestalling risk of loss, panic or distress.

Today's increasing dependence on electrical facilities makes stand-by power a vital necessity in stores, hospitals, schools, theatres—public buildings of all kinds, as well as homes. Kohler plants are economical to operate, easy to maintain, known everywhere for reliability.

To help you write specifications, a complete manual will be sent on request with data on sizes from 1000 watts to 115 KW, gasoline and Diesel.

Write Dept. K-28. See us in Sweet's Catalog.

KOHLER CO. Established 1873 KOHLER, WIS.

#### KOHLER OF KOHLER

ENAMELED IRON AND VITREOUS CHINA PLUMBING FIXTURES • ALL-BRASS FITTINGS

ELECTRIC PLANTS • AIR-COOLED ENGINES • PRECISION CONTROLS

are usually wasteful; (3) to maintain the closest possible liaison between the sales and process development sections."

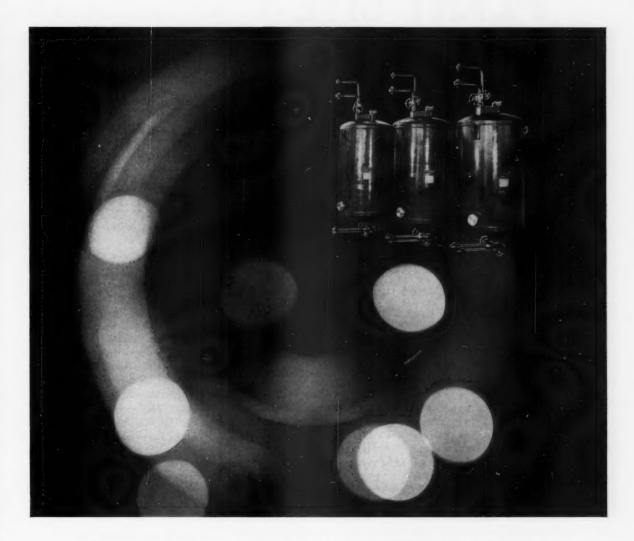
Souren Z. Avedikian, director of the Engineering Development Center for Lummus, defined a package plant as "one that comes as a unit, fully assembled or in a knockeddown condition for assembly at the site. It is completely or largely shop fabricated, is self-contained in respect to piping and electrical wiring, and is ready to be hooked up to utilities at the site."

Among the advantages to the client of having a package plant, according to Avedikian, are that one engineering effort can serve for several installations; unskilled labor troubles are avoided by shop fabrication; and the client can beat the others on the market with a competitive product because of time savings in installation. Disadvantages include higher shipping costs and possible boundary and custom troubles.

A consultant in the audience pointed out that engineers in private practice "can't go peddle a design to a dozen others, because our designs belong to our clients. Are you also putting the skid under consulting engineers? Do you use consultants or compete with them?" He was told that in some cases, the package designers undertake projects on which the plans belong to the client upon completion. Avedikian also stated that Lummus uses consultants continuously.

#### Registration ...?

In California, a bill has been proposed specifically to include industrial engineers in the registration laws. According to the bill, an industrial engineer is "one who deals with the design, improvement, and installation of integrated systems of men, materials, and equipment, drawing upon specialized knowledge and skill in the mathematical, physical, and social sciences together with the principles and methods of engineering analysis



Atoms and lons... An essential in nuclear energy conversion to electric power is ultra-pure water. In the primary loop of the reactor, the water could gradually accumulate radioactive particles if not treated. The secondary loop, as in conventional boilers, requires removal of silica from the makeup water to safeguard the turbines. Silica forms a glassy deposit on turbine blades that can impair generating efficiency, causing ultimate shutdown for removal with attendant costs. To insure against such an eventuality, thousands of minute ion-exchange beads in Cochrane demineralizers remove these contaminants effectively. Cochrane scavenger precoat filters and demineralizers are also highly efficient in removing traces of iron, copper and other solids from condensate in conventional and once-through boilers. Safeguard your equipment with a call to Cochrane. In water conditioning... the name is Cochrane. For a copy of our handbook on demineralization, write on your company letterhead to Cochrane Division, Crane Co. 3112 N. 17th Street, Philadelphia 32, Penna.

#### COCHRANE DIVISION

Division of Crane Co. . Philadelphia 32, Pa.

AT THE HEART OF HOME AND INDUSTRY



VALVES AND PIPING . ELECTRONIC CONTROLS
PLUMBING . HEATING . AIR CONDITIONING

# PLANT SITE PROBLEM?

Q. Want to know where to get detailed, factual information about labor supply, market potential, raw materials?

A. Niagara Mohawk's area development specialists have a wealth of such data about Upstate, New York right at their fingertips.

Q. Wondering how to solve special plant site problem unique to your company'.

A. Niagara Mohawk can help with special research to get the answers you need. Work for other companies has ranged from finding a special type of water for one, to locating a special type of labor force for another.

Q. Want evidence that your kind of business can prosper in Upstate, New York?

A. New York is the most highly diversified area in the Union. It has the highest average of skilled workers and foremen in its labor pool...natural resources are abundant and varied...plenty of clear, clean water...big timber tracts...plenty of low cost electric power and natural gas.

Q. Transportation a vital consideration for you?

A. Air, rail and superb Thruway facilities provide overnight access from Upstate, New York to the great metropolitan markets of the northeast and neighboring Canada. And you can reach the seaports of the world through the new St. Lawrence Seaway.

Q. How's the living in Upstate, New York?

A. Plenty of elbow room here, and plenty of recreation facilities. Fishing, hunting, golf, boating, skiing, some of the world's finest parks and preserves. A fine place to raise children... New York's educational system is second to none.

Q. How do you get more information about solving your specific plant location problems?

A. A phone call, wire or letter will get the ball rolling. Contact Richard F. Torrey, Niagara Mohawk Power Corporation, Dept. CE-6, 300 Erie Blvd. West, Syracuse 2, N. Y. Phone GRanite 4-1511. No obligation, and completely confidential, of course.



and design to specifically predict and evaluate the results to be obtained from such systems."

Also in California, a bill has been introduced that would create and license "building designers." Under this law, a building designer would be one who designed buildings not more than two stories high. No educational requirements are listed. The prospective building designer would be more than 21 years of age, with good moral character and four years experience in building design.

In New York, a bill that would have included "safety engineers" under the licensing laws was defeated. The death of this bill in committee caused a sigh of relief in the New York State Society of Professional Engineers, which had opposed it.

But a professor at the University of Illinois has topped them all, suggesting creation of the "instrument engineer." The instrument engineer would be the person replacing the scrub nurse in handing doctors the forceps. The professor added that since the job is purely technical, the engineer would need no instruction in nursing care.

#### **AIA Discipline**

The Board of Directors of the American Institute of Architects, at a recent meeting, voted to suspend two and censure three members of the New York firm of Voorhees, Walker, Smith, Smith & Haines. The action was taken on complaint of the architectural firm of Moore & Hutchins, charging VWSS&H with violation of AIA Mandatory Standards 9 and 10, dealing with one architect's taking over a job for which another already has been commissioned.

The project in question was the New York State University College at Stony Brook, Long Island. In 1957, the complainants, with the firm of Clark & Rapuano, were designated by the State of New York as architects for the project. Subsequently, following completion of



### How Sylvania's

## Sylva-Flo Troffer with Multi-Vent<sup>®</sup>

gives you

- as much as 20% more light output
- longer ballast life
- true lamp color
- reduced maintenance and operating costs
- superior room air-conditioning

Sylvania's Sylva-Flo Troffer with Multi-Vent provides you with more than the convenience and economy of combining Lighting and Air Distribution in one efficient unit. It actually increases the quantity and improves the quality of the lighting system. Here's how...

Temperature affects the lighting efficiency of a fluorescent lamp. And the heat that builds up in a conventional troffer (or in a combination unit that isolates lamps from the air flow) reduces the light output of the lamps by as much as 20%. This heat build-up also has other effects. It shortens the life of the ballasts. It also affects the phosphors in the lamps, causing some variation from their designed color.

Now look at the illustration of Sylvania's Sylva-Flo Troffer using Pyle-National Company's Multi-Vent System of low-velocity air distribution. As the air passes through the fixture, it clings to the sides and flows out of the openings into the room area. As this air is directed through the fixture, the heat generated by the lamps is drawn into the air stream. The removal of this heat cools the lamp chamber.

The cooler temperature within the lamp chamber resulting from this heat removal . . .

... increases the light output of the fluorescent lamps as much as 20% (as compared to a troffer without air flow or to a combination unit with isolated lamp chamber) because the lamps are operating nearer their peak efficiency.

. . . adds appreciably to the life of the ballasts.

. . . permits the lamps to operate nearer their intended color.

In an installation where all fixtures handle air, as recommended, these benefits result from both the "supply" and "return" troffers.

In addition, the air passing through the "return" units prevents a large percentage of fixture heat from reaching the room area and minimizes dirt collection. In most installations, this lowers initial, operating and maintenance costs.

Sylvania's Sylva-Flo Troffer using the Multi-Vent System features a *coalescent* air stream which brings a continual, comfortable, gentle flow of *fresh*, conditioned air down into the occupied area. This low-velocity system provides many distinct advantages over other air distribution methods.

Because of these outstanding features, you should investigate Sylvania's Sylva-Flo Troffer with Multi-Vent fully before specifying. To obtain full detailed information, see your Sylvania representative or write for our new 20-page booklet.

SYLVANIA LIGHTING PRODUCTS

A Division of SYLVANIA ELECTRIC PRODUCTS INC.

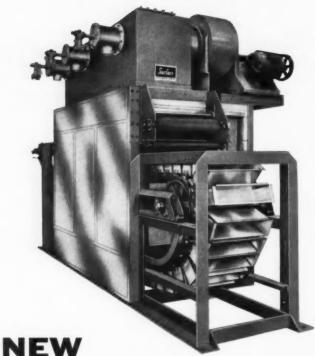
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continuous automatic drying and toasting

This toasting machine, long in development at Kathabar laboratories, may be precisely the means of putting your drying, puffing, and other high temperature processing operations on a continuous basis. Stainless steel trays convey the material, while in a "fluidized" state, through the oven under precise temperature control. Make use of Kathabar's unique fund of hard-earned experience in continuous automatic control of temperature and humidity to speed the processing of a wide range of foods and chemicals.

#### KATHABAR

where the experts turn for help

a division of Mid	lland-Ross Corporation
Please send facts on \( \square drying \)	toasting for following application
name & title	
company	
street	

a master site plan, the State cancelled its contract with Moore & Hutchins and Clark & Rapuano, and entered into negotiations with the firm of Voorhees, Walker, Smith, Smith & Haines.

The Board ruled that the Voorhees firm had violated the Mandatory Standards. Charles Haines was suspended for two years, and Perry Coke Smith was suspended for one year. The other three members of the firm were censured.

#### Licenses Expire

Engineering licenses in 10 states are scheduled to expire on June 30. Consultants registered in the following should check for renewal: California, Delaware, Idaho, Kentucky, Massachusetts, Nevada, Oklahoma, Rhode Island, South Carolina, and West Virginia.

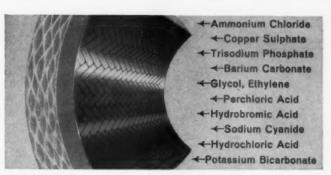
#### Michigan Meeting

Free enterprise was the theme for the 3rd Annual Conference of the Consulting Engineers Association of Michigan, held on April 14.

The Michigan Registration Law, recently declared unconstitutional, received only passing attention. Robert Gove reported that an amendment already had been introduced in the state legislature, which would make the law constitutional in the opinion of the presiding judge in the ill-famed GE-Modern Engineering Service Co. case. It subsequently passed in both the senate and the house.

In line with its bifurcated position regarding the Consulting Engineers Council and the National Society of Professional Engineers, CEAM called on representatives of both to explain their activities dealing with the promotion of private practice in the face of growing competition from government. Charles C. Pate, of Oklahoma, gave the CEC story, and Clyde E. Williams, of Indiana, represented NSPE.

Actually, the CEC and NSPE approaches to the promotion of free enterprise in the practice of



CORROSION-RESISTANT TO CHEMICAL ATTACK—Fibercast has outstanding ability to withstand corrosive chemicals and gases. Its unique construction provides many advantages. Fibercast is a centrifugally cast thermoset epoxy resin reinforced pipe with multiple layers of glass fibers embedded and bonded by heat to provide chemical resistance, high strength and long service life.

## Remarkable Fibercast pipe safely handles 94% of known corrosive solutions

- Copes with temperature range from −65° to +300° F
- · Withstands operating pressure range to 1200 psi
- · Handles 320 of the 338 most corrosive solutions
- · Available in pipe sizes from 2" to 8" with fittings

You see above the dramatic ability of Fibercast pipe to "live with" punishing chemicals without ill effects—without trace of corrosion or scale,



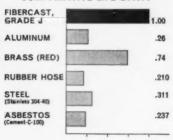
Fibercast has built-in inhibitors you can depend on to combat corrosion, contamination, scaling, electrolytic action. It is capable of withstanding sudden temperature differentials from cool liquids to hot gases or steam. It's good for all operating pressure ranges to 1200 psi.

Fibercast's lightweight means substantial savings in installation costs. No painting or maintenance is necessary,

The inner walls are ceramic-smooth, discouraging build-up of scale or de-

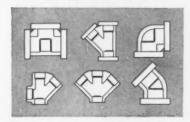
posits to clog or jam the system, saving downtime, replacement and repair. The Hazen-Williams C Flow Factor of Fibercast is 147.

#### COMPARATIVE LIFE DATA\*



\*Basing Fibercast as unit life of 1 and others as comparative percentages thereof.

The combination of benefits inherent in Fibercast are not found in any other kind of pipe: aluminum, brass, steel, stainless, asbestos, rubber, glass, plastic. Fibercast offers exciting new possibilities to solve the processing problems of your plant. It is resistant to most liquid and gaseous industrial chemicals and products, liquid foodstuffs and other difficult materials.



Fibercast is now available in sizes from 2" to 8" with the world's most complete stock of couplings and fittings. For more detailed information, mail coupon.

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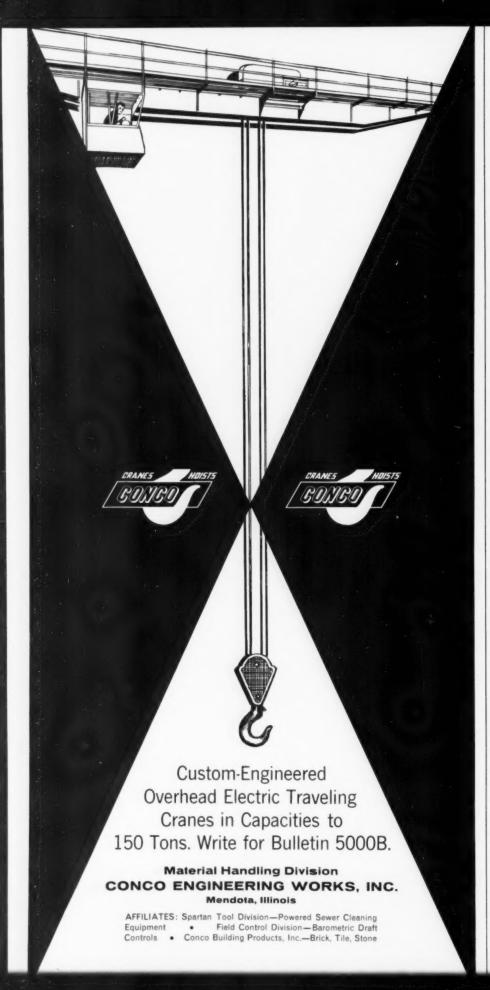
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SHEET AND TUBE COMPANY

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Please send me, without obligation, further details about Fibercast Tube and Pipe.

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Title
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City Zoon State



engineering dovetail rather nicely. The CEC approach seems to be a massive frontal assault on all levels of government where the socialized practice of engineering has taken root. On the other hand, NSPE is working primarily in Washington, dealing with specific matters of immediate concern.

It is increasingly evident that if consulting engineers are to fight the steady growth of government engineering bureaus, they are going to have to get together with other members of the building industry. Pate, an ardent exponent of political action, presented copies of "A Memorandum to the Oklahoma Congressional Delegation Supporting the Position of Private Enterprise in Governmental Public Works." It is an excellent brochure, well fortified with substantiating data, but the important thing is not so much its content as its source. It is the joint work of the Consulting Engineers Association of Oklahoma, the Oklahoma Chapter of the American Institute of Architects, the Oklahoma Society of Professional Engineers, the Oklahoma Municipal Contractors Association, the Oklahoma Builders Chapter of the Associated General Contractors of America, and the Oklahoma Association of General Contractors - Highway and Heavy Branch. If other consulting engineer groups, whether CEC or NSPE, can spearhead similar action in other states, they might yet influence the Kennedy administration while in its formative stages.

One important warning was sounded at the CEAM meeting. O. Germany pointed out that consulting engineers, in their enthusiasm for the free enterprise program, might endanger their professional position by forgetting their obligation to the public health and welfare. It is important, he pointed out, that the promotion of the private practice of engineering be presented in context with the attendant benefits that will be gained by the general public.

CONSULTING ENGINEER



## WHITE/SUPERIOR ENGINES OPERATE ON FREE SEWAGE GAS

at Hamilton, Ohio's 12,000,000 gallon per day sewage treatment plant

Two White Superior 6G-825 gas engines at Hamilton, Ohio's new activated sludge type sewage treatment plant are saving taxpayers thousands of dollars yearly. Engines operate on free sewage gas produced in the plant digesters. The Superiors, each rated 300 bhp at 690 rpm, drive blowers with a total capacity of 14,000 cfm to aerate sewage. Heat from engine cooling water also helps heat the buildings.

Superiors also feature outstanding design simplicity, with fewer moving parts than comparable power units. Maintenance and repair costs are minimized, and re-

placement parts are seldom needed, even after extremely long periods of operation.

White Superior covers every municipal power requirement with a complete line of dependable diesel, dual-fuel and gas engines, 190 to 2150 hp, or 150 to 1500 kw. Write for literature today! WHITE DIESEL ENGINE DIVISION, Springfield, Ohio.





# 8 types of Westinghouse bus duct— WHY?

PLUG-IN . . . For industrial or commercial applications . . . 225- through 1000-ampere ratings. Plug-in outlets every 12 in. along run. Good for meeting changing requirements in industrial plants.

LOW IMPEDANCE . . . Maximum efficiency for long feeder runs . . . 600-through 5000-ampere ratings. Indoor or outdoor applications. A wide variety of special fittings makes this bus duct most flexible to meet special requirements.



PLUG-IN LOW IMPED-ANCE . . . Combines the high efficiency of low impedance design plus the convenience of plug-in receptacles. Ratings 600 through 4000 amperes. Accepts standard 3-pole plug-in devices, interchangeable with corventional plug-in duct.



LIFE-LINE . . . A plug-in bus duct with the ultimate in safety features. The plug-in unit can be completely installed and wired before contact is actually made with the bus bars. Ratings 225 through 4000 amps.



Simply because no one type will properly meet all duct applications. When the factors of voltage drop, frequency, over-all cost, capacity and plug-in features are weighed, it takes many types to do the job properly. That's why Westinghouse makes 8 specialized types of duct.

To the consulting engineer, this means the opportunity for optimum design; to the contractor it means fast installation; to the plant engineer it means power savings and low maintenance.

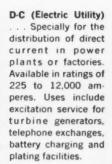
Want complete information on how these 8 types of Westinghouse bus duct can provide a long and useful life for a new building or a new lease on life for an old one? Contact your Westinghouse representative or write: Westinghouse Electric Corporation, Standard Control Division, Beaver, Pa.

#### Westinghouse

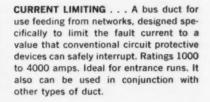


HIGH-FREOUENCY...

Most efficient of all power distribution systems for high-frequency application-400 cycles and above. Voltage drop of less than 1 volt per 100 ft at full load. Has plugin convenience for easy power take-off. Typical applications include aircraft or electronic manufacturing, induction heating and many others.

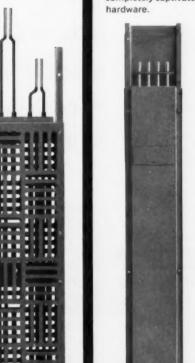


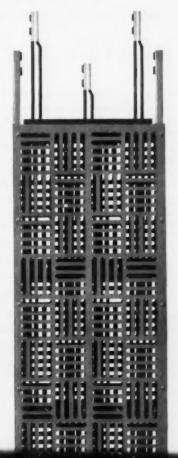


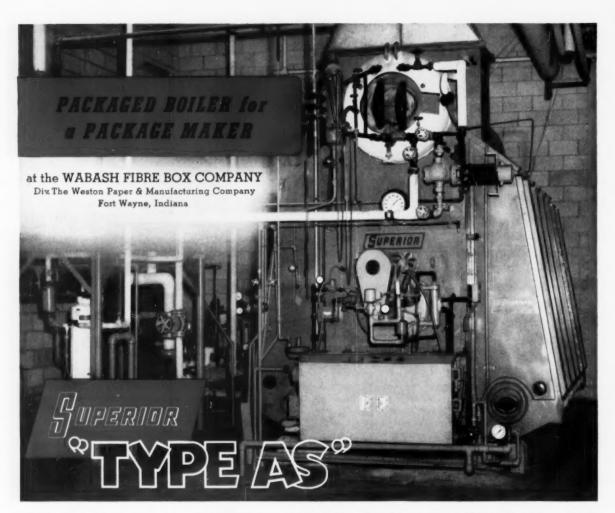












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Note in this Type AS installation, the uncluttered firing front... result of rear-mounted draft fan and soot blowers. Note controls at floor level, affording accessibility without need for ladders or platforms.

The boiler's baffleless design (unusual in boilers of this capacity) results in complete freedom from dangerous gas pockets. With its Superior Rotary Burner, maximum safety and efficiency for fully automatic operation are assured.

To be used for both heat and process, providing 13,000 lbs of steam per hour at 190 psig, Superior's Type AS Completely Packaged Boiler was selected as the ideal ''package'' for this package maker.

For condensed data describing the World's Most Complete Line of Packaged Boilers, write today for Catalog S-13

Fire-Tube and Water-Tube PACKAGED BOILERS

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ORDERLY BOILER ROOM LAYOUT

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#### Finding and Hiring Engineers



There is a right way –
and a wrong way –
to go about it

MARJORIE ODEN, Eastern Editor

RECENTLY, the "perfect engineer"



applied for employment to 100 of the largest corporations currently advertising for engineers. Replies to the application var-

ied from inept to excellent to rude. One thing was proven conclusively: effectiveness in handling job applications is not a function of company size or advertising budget, but it is a definite factor in successful hiring of competent help.

Sherman Boxer, executive vice president of Equity Advertising Agency Inc., told of a Connecticut executive who will not let representatives of one company on his firm's premises. Years ago, when the executive was a recent engineering graduate, he applied for a job and was given an impolite brush-off. "Nobody knows how many millions of dollars the brush-off has cost that firm," Boxer added. The executive is head of a firm using components which could be purchased from the place he once sought to work.

Boxer's is one of the larger firms specializing in technical recruitment advertising. They take frequent surveys to find out why companies are or are not hiring men as a result of the ads they place. The treatment given the "perfect engineer" proved that firms spending thousands of dollars for advertising sometimes do not know what

to do when, in response to the firm's ad, a man applies for an engineering position.

#### "Michael Carlson"

The imaginary engineer was a composite of what most of the ads indicated was needed. He was in his middle thirties, married, and in excellent health. He had an MS in electrical engineering and had pursued additional studies in physics at the graduate level. Both BS and MS degrees were from institutions in the top ten technical colleges and universities. After getting his MS, the engineer had stayed on the same job for nine years, advancing to group leader level, where current responsibilities included directing eight other engineers and several technicians. He was earning \$15,000 to \$16,000.

The resume of "Michael Carlson" could not have been on one desk 10 minutes when a telegram was sent asking that he contact the firm immediately for an interview. Another firm, which spends an estimated \$200,000 a year for technical advertising, waited 87 days to answer the inquiry. With another 83-day-late answer came a package of printed brochures and data.

"Some firms spend millions in advertising and then do not act on replies," Boxer lamented.

Another firm, which uses extensive advertising and distributes



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   Automatic equipment for de-ionization.
   (Our broad experience dates from 1948.)
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Rubber Disc Sizes: 4" through 12"

Working Pressures: Cold Water 200 lbs.

These valves prevent backflow and provide a leak-proof seal with rubber disc. They may be installed in horizontal or vertical position with upward flow.

When more positive control of the disc is needed, valves may be supplied with either a lever and spring or a lever and weight. Either can be adjusted to exert the required pressure on the disc when the valve is in operation.

• Write today for complete details.





Fig. 106



Fig. 106LS

Cutaway view showing disc
with external view of lever
and location of spring.



Fig. 106LS

Exterior view showing spring and method of mounting on the valve body.

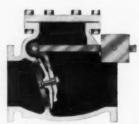


Fig. 106LW

Interior view of disc showing attachment of lever with exterior view of weight.



KENNEDY VALVE MFG. CO.-

ELMIRA, NEW YORK VALVES . PIPE FITTINGS . FIRE HYDRANTS

OFFICES AND WAREHOUSES IN NEW TORK, CHICAGO, SEATTLE, SAN FRANCISCO, ATLANTA & SALES REPRESENTATIVES IN PRINCIPAL CITIES .

four-color recruitment brochures, answered the application with a postcard that said: "Your letter of application for employment with the Blank Company has been received and is presently being reviewed by members of our Technical Staff. As soon as we have some definite information relative to this inquiry we will contact you. Thank you for your interest in the Blank Company." The postcard was unsigned. In addition to the curtness of the reply, this company is forever on the applicant's list for another reason: most engineers apply for a new job while still employed. If an employer had not known his engineer was looking around, this would tell him.

A rather chatty letter, which sounded as if the company was taking a real interest, was unsigned. One of the more interesting replies was an offer to list his name in a catalog so the company could consider him if they needed men in future years. Many firms might not need engineers, but they could certainly use some secretaries. One letter contained 11 grammatical errors.

Of the telegram replies, 17 said: "Call company collect to arrange immediate interview." One stated the firm was interested in his experience, and was sending a job application form by mail.

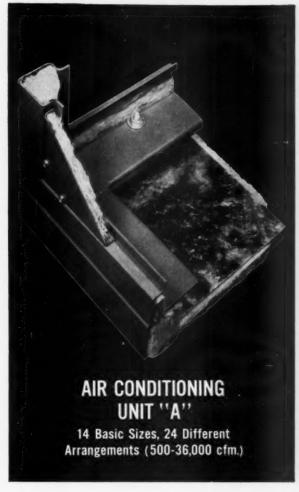
The letters said: Contact immediately to arrange interview, 10; Fill out enclosed job application form and return, 42; Come at your convenience for personal interview, 2; Will be in contact again as soon as engineering staff has evaluated resume, 4; Send additional information on experience and salary required, 4; No openings presently available, 9. Approximately one-fourth of the letters ended "Thank you for your interest in..."

#### **Answering Applications**

What is the correct way to answer a job applicant?

¶ Boxer thinks a letter should be from an employee on or above the

#### A test: inspect these frames





#### Now, who are the 2 manufacturers?

True, Unit "D" construction could be confused with that on any of several well-known central station air conditioning units.

But it would be hard to mistake Unit "A" for an industry standard. "A" is the exclusive Penta-Post and double drain pan construction offered as standard on *only* Kennard/Nelson *Better Air* (Type A) air conditioning units.

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Better Air features . . . designed expressly to "meet or exceed" all industry standards.

Two lines. One manufacturer. A Kennard/Nelson line for projects where quality comes first *plus* one for those where an "industry standard" is required.

Your Kennard/Nelson representative will demonstrate these frame styles in your office. Call him or write for literature on these units: American Air Filter Company, Inc., 300 Central Avenue, Louisville, Kentucky.



job level of the applicant. (Onethird of all replies were from personnel on a clerical level, but one came from an "Experienced Recruiting Director.")

¶ The letter (three pages, maximum length) should sound as if the company is taking a personal interest in the applicant — even if the firm's standard form letter has to be rewritten.

¶ The letter should tell a little about the history, current projects,

and specialty of the firm. It should give an optimistic picture of future growth, say where the man could fit into the organization, describe the job available, give long term prospects for promotion, and mention that "salary will be negotiated." Mention the advantages of the firm's location, and "it is very important to include the high quality of local schools," Boxer added. Recruiting surveys also have shown that during the past 10 years, engi-

neers have begun to ask about cultural activities in prospective future locations.

"Telephone calls are less effective with a top man than with a junior employee," Boxer said. He added, "And if you feel a telephone call would be justified, use the above outline for the conversation and then send the letter to confirm the conversation."

If an engineer is coming for an interview, his ticket or total travel expenses should be sent in advance. "Most engineers would not take advantage of money in advance, and regardless of their present position, most men like to get the money in advance."

The applicant should be met at the airport, taken to dinner if time allows, and driven back to the airport. Also, he should never be left sitting around a reception room. "We have found these little things increase the success factor of hiring by a multiple of at least five," Boxer stated.

"If you are not currently interested in hiring a man, tell him 'No' in the banks' manner. You can tell him 'No' in such a nice way that he will retain a favorable image of your company.

"Whether you think you ever will be interested in hiring the man or not, tell him in your answering letter that you were most impressed with his resume but business is such that you cannot hire him at this time (or you are already overstaffed). Add that you are placing his resume in your active file and probably will contact him again. Then do not follow the example of one firm, which clipped the resume to the applicant's letter."

Since an estimated 20 percent of the employed engineers usually could be convinced to change jobs, a file of past applicants is almost timeless. "This is providing the engineer gave you his home address. Do not approach him more than six months later if he gave a company address. You would run the risk of alienating his employer."



MR. ENGINEER:

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Interior Vitro-Tech Corp., Hearne, Texas



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#### Financing Utility Lines

An upstate New York bank works with consultants to finance suburban utilities

IN PREPARING plans for water and sewer lines in a community without them, one of the major concerns for a consulting engineer is a public presentation of the project, explaining to the people how much the project will cost, and how it can be paid for. Ordinarily, communities planning these utilities are able to authorize a comparatively simple bond issue. The taxpavers in the area consider the installation of these utilities a major improvement, and usually agree readily to the bond issue. However, many of these taxpayers and homeowners are taken aback when they discover that they personally will have to pay the cost of installation from their homes to the service line.

It is this added personal expense that many consultants find the stumbling block in trying to convince a community of the advantages of municipal water and sewer facilities. Depending on the section of the country and the setback from the main to the house, the cost for the utility hook-up can run from \$250 tc \$1000. Many homeowners feel that they just cannot afford the changeover from wells and septic tanks to water mains and sewers.

#### A Solution

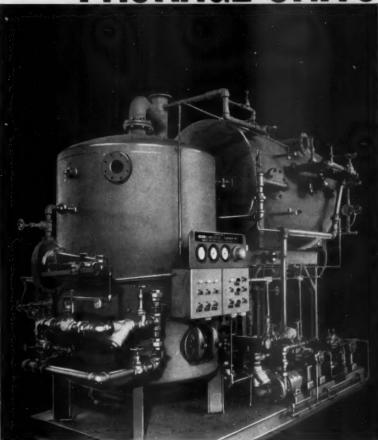
The Central Trust Company, of Rochester, New York, has cooperated actively with consulting engineers in working out financing arrangements for taxpayers in newly formed water and sanitary districts. They have developed two basic plans to help individuals meet the expense of connecting into new utilities. One is an Advance Savings Plan, the other a Utility Improvement Loan. Either or both of them could easily be adopted by banks in other parts of the country, if the consultant can show bank officials and taxpayers their advantages.

The Advance Savings, or Advance Reserve Plan, is similar to Christmas Clubs and Blessed Event Clubs already in operation in most banks. The only difference is that the Advance Reserve fund draws regular interest, and can be added to in any amount at any time.

The Utility Improvement Loan is a regular six percent bank loan. After signing the agreement with the bank, the homeowner authorizes a contractor to make the utility hook-ups, then sends the bill for the completed work to the bank. The bank pays the bill, and the homeowner pays it off in monthly installments over a period of up to three years. Thus, an installation charge of \$400 could be paid off in three years at the rate of a little more than \$13 a month. The bank provides insurance on the loan for both husband and wife, so that if either dies, the loan in paid off. There is no charge for this life insurance, and accident and sickness insurance can be added at low cost.

Bank officials report the loan plan has received popular acceptance because of its simplicity and directness. Also, it has proven a great aid to consultants and public officials in securing public approval for improvement plans.

# MICKES standard BOILER AUXILIARY **PACKAGE UNITS**



Save On First Cost . Engineering . **Building Space • Construction Time • Operating and Maintenance Cost** 

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**JUNE 1961** 

85

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#### Engineers' Contract Forms

page 100

Needed: Lighting Design page 94

Bridges ... Weld or Rivet?

page 111

More on Æ Relations page 108

Converting Saline Water page 105

England to France Tunnel page 124

Air Conditioning Problems
page 116

Belidor on Waterways
page 128

#### The Readers' Guide

"Certainly, there are excellent standard forms available, but there is no substitute for some careful thought about the content of the [engineering] contract." George L. Levin points out the necessity for adequate and accurate contract forms.

"[Illumination] is probably the least understood branch of engineering . . . [because of] the engineer's belief that the subject is so simple that he does not need to study it. But it can . . . become extremely costly when treated lightly." L. G. Parks emphasizes the importance of careful design and specification of luminaires.

"The only means of firmly establishing an accurate cost comparison is by preparing complete plans for both designs and taking alternate bids." Norman Marks investigates the relative costs of different construction methods on Pittsburgh's new Glenwood Bridge.

"[Architecture] is at last taking steps to make the engineer a part of the design team." Architect-engineer Robert Hastings adds his thoughts to Consulting Engineer's series on  $\boldsymbol{\mathcal{E}}$  relations.

"... development... requires processes that will produce water at lower cost [than \$1 per thousand gallons]." Dr. Raphael Katzen examines the status of various water desalinization processes.

"Throughout the report . . . published by the Channel Study Group in 1960 . . . runs the theme that a Channel tunnel is a practical proposition." A London *Economist* report studies the details of plans for a tunnel from Great Britain to continental Europe.

"The greatest influence in selecting air conditioning and air distribution systems is the basic size and shape of the building. Budget limitations on construction, the occupancy, and lighting levels . . . are other strong factors." Sidney Littmann compares the air conditioning problems found in different types of buildings.

"... of the Arts to which necessity has forced man to apply himself, there is none of greater interest... than that by which he brings under control the flow of water." James Kip Finch concludes his series on the 18th century Frenchman, Bernard Belidor.



#### PERFORMANCE-PROVED TUNNEL LIGHTING





15 years in the design, engineering and manufacture of lighting equipment for tunnels and underpasses positively qualifies Sunbeam Lighting Company national leadership in this intricate field. Thousands of fixtures in various parts of the country have withstood the harsh tests of time, weather, and extreme service conditions.

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Write for Bulletin T22 showing how Sunbeam performance-proved # 2200 tunnel lighting equipment can readily solve your needs.







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Get Youngstown Buckeye and corrosion resistant Yoloy rigid conduit and EMT. Buckeye for standard installations. Yoloy where corrosion is a problem. Match your needs exactly with the quality Youngstown steel conduit made to meet them.

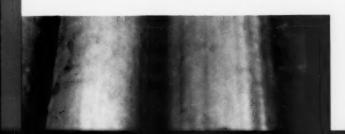
Choose Buckeye or Yoloy Hot Galvanized conduit. Even the threads are galvanized. Choose Buckeye Electro-Galvanized conduit. Clear enamel interior fishes easier. Choose Buckeye or Yoloy Black Enameled steel conduit. The finish won't wrinkle or crack when bent. Or choose Buckeye or corrosion-resisting Yoloy EMT. Electro-galvanized, coated inside and out with smooth clear enamel.

With any Youngstown quality steel conduit you get easier, kink-free bending. You get smoother threading. Clean, trouble-free handling. Faster fishing. Service masts you don't have to guy. And a modern raceway system that looks as good as it works.

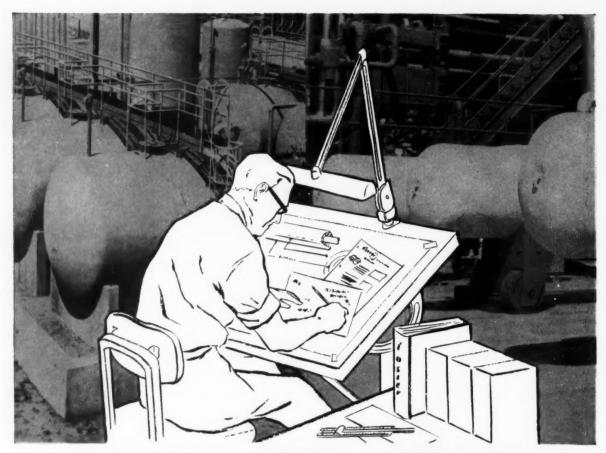
On your next job, specify Youngstown steel conduit. It is readily available in sizes  $\frac{1}{2}$ " to 6". Get prompt delivery from your electrical distributor.



Youngstown - growing force in steel



For complete information on Youngstown steel conduit, write, Dept. 26-A, The Youngstown Sheet and Tube Company, Youngstown, Ohio



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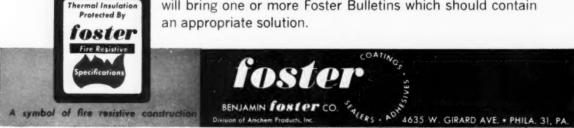
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When the thermal-insulation specification includes the name "Foster," you're assured a protection system engineered to resist practically every condition the insulation can be expected to encounter. And only with the proper protection will the insulation perform efficiently.

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Presenting . . .

#### Our Authors

Raphael Katzen graduated from Brooklyn Polytechnic Institute in 1936 with a Bachelor's degree in chemical engineering. He returned to BPI for a Master's degree, and in 1942, a doctorate in chemical engineering. Katzen has a consulting engineering firm in Cincinnati, and is president of Raphael Katzen Associates International, Inc., doing engineering work in Latin America and Canada. He is a member of NSPE, AAAS, and AIChE. His article on the conversion of salt water is on page 105.





Sidney Littmann studied mechanical engineering at Washington University, and received his BS there in 1934. During World War II, he worked as an engineer in the piping and air conditioning section of the Puget Sound Naval Shipyard. At the same time, he took advanced work at the University of Washington. In 1948 he went to work for Giffels & Rossetti, in Detroit, and became chief mechanical engineer in 1957. His article on the selection of air conditioning systems is on page 116.

Leonard Parks attended the State University of Iowa, where he earned a BS and MS in electrical engineering, with a major in illumination. He served in the U.S. Army for four years, and in 1946 went to work for Ebasco Services, Inc., where he is now a supervising electrical engineer. Parks was chairman of the IES Industrial Lighting Committee and member of the International Commission on Illumination. His article on the importance of engineered illumination is on page 94.



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Write for Bulletin A759
Dept. F-7, E. Seventh Ave., Gary, Indiana

ROCKWELL-STANDARD



Grating Division, Gary, Indiana

George Levin received his BS from the University of Minnesota in 1939; two years later he received an MS in architectural engineering from the same school. He served as an officer in the U. S. Navy for five years during World War II. In 1949, he began private practice in St. Paul, Minnesota, and currently is registered



in 12 states. Levin is a member of NSPE, MACE, AAAS, and MSPE. His article on contract forms and their differences begins on page 100.



Norman Marks graduated from the University of Pittsburgh in 1948 with a BS in civil engineering. Before that, he had served in the U. S. Air Force during World War II. In 1955, he went to work in the Pittsburgh consulting firm of Richardson, Gordon, and Associates, advancing to associate in 1957, and becoming a

full partner in the firm this year. He is a member of ASCE. His article on the relative merits of welded and riveted bridge designs is on page 111.

Robert Hastings graduated from the University of Illinois in 1937 with a BS in architectural engineering. He joined the Detroit firm of Smith, Hinchman and Grylls, Associates, Inc., and except for two years during World War II, has been with the firm since. In 1943, he became project director, and in 1951, vice president.



Last December, at the age of 46, Hastings was elected president, the youngest in the firm's history. His article on inter-professional relations is on page 108.



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### HOW TO GET REMOTE LIQUID LEVEL READINGS

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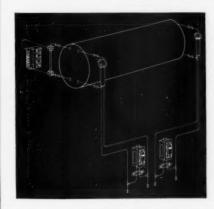
Dependability is the key to successful remote indication of liquid levels. To be dependable, indicating instruments must be accurate and visible. YARWAY REMOTE LIQUID LEVEL INDICATORS offer both these features—and a record of more than 16,000 successful installations in utilities, industrial plants, institutions and marine service.

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Under A. S. M. E. Boiler Code Committee ruling in Case # 1155, two independent remote level indicators of compensated manometric type may be used instead of one of two required gage glasses for boiler pressures 900 psi and above. When both indicators are in operation, the gage glass may be shut off but shall be maintained in serviceable condition.

Yarway Remote Liquid Level Indicators conform to and are widely used under this ruling.

If you would like a copy of this Boiler Code ruling, just write and ask for Case #1155 reprint.

# What Luminaires Really Cost

L. G. PARKS Ebasco Services, Inc.

OF ALL THE BRANCHES of engineering involved



in the design and construction of modern buildings, the one that receives the least investigation and analysis is

illumination. It is the newest, and, contrary to popular opinion, probably the least understood branch of engineering. This lack of understanding results not from inability to comprehend, but rather from the engineer's belief that the subject is so simple that he does not need to study it. Illuminating engineering, like any other engineering involved in building design, presents no unsolvable problems to the informed engineer. But it can cause painful embarrassment and become extremely costly when treated lightly.

The boom in office building construction during the past decade has been accompanied by a new awareness on the part of the building owners of the need for, and value of, modern lighting. It can enhance the interior appearance of a building as well as provide the level of illumination required for the visual tasks to be accomplished. In the modern office building, and many industrial buildings as well, lighting has become a part of the interior decoration. Luminaire design has been developed to complement the architectural features of the interior. With this the lighting engineer cannot argue. On the contrary, he is happy to have lighting accepted as part of the over-all design.

The building owner is, of course, interested in low initial cost. To achieve this, he is faced with the necessity of reducing costs wherever he can. Interior lighting is one area that offers possibilities. A reduction in the installed cost of the luminaire appears to effect a reduction in over-all cost. The dangers inherent in this thinking are serious and may prove very costly. When luminaire costs are reduced beyond a determinable point for a given level of illumination, the building costs actually begin to increase — usually without the owners knowledge.

To most owners, a luminaire is a luminaire. Unfortunately, it is not so simple. There is a great range in the performance of apparently equivalent luminaires. The popular 2-ft by 4-ft, 4-lamp, recessed troffer is available in a variety of depths, lamp and ballast arrangements, and light control media. In fact, the only non-variables in its construction are its 2-ft width and 4-ft length.

As might be expected, the luminaire cost also varies. Generally speaking, a reduction in luminaire cost is accompanied by a compromise in the desirable characteristics of the luminaire. This compromise usually results in a reduction in the efficiency and the coefficients of utilization, and an increase in luminaire brightness. An owner concerned only with the initial cost of a luminaire is usually unaware of this compro-



mise or underestimates its effect upon his costs. To an informed engineer, these effects are important, and the dollar difference in value received is very real.

When the owner makes a luminaire selection on his own initiative, he usually does so because he:

¶ Is unaware of the potential cost of cheap luminaires. ¶ Lacks appreciation of the benefits to be derived from quality luminaires.

Is convinced that by working through his own channels he can secure a rock bottom luminaire price.

¶ Is considering only architectural features such as appearance, modular conformity, or artistic harmony. ¶ Has reciprocity arrangements with other firms.

In terms of the over-all cost of the lighting installation, none of these is a good reason for making a specific luminaire selection. Actually, if either of the first two applies to the owner, it is evident that he needs sound engineering advice. The consultant must provide it.

An owner's endeavors to secure rock bottom prices also could bring about his own undoing, and the consultant must prevent this. Manufacturers' advertising claims seldom can be checked unless they are based on the reports of a recognized photometric testing laboratory. The availability of such reports is often an indication of good faith on the part of the manufacturer, but even when readily available, they must

be evaluated by a thoroughly experienced engineer. As a result of this evaluation, the consulting engineer can advise the owner on:

¶ Efficiency of the luminaire — the percentage of lamp lumens which are emitted from the luminaire.

¶ Brightness of the luminaire — brightness level at various viewing angles and how this compares with standards of quality of lighting.

¶ Coefficients of utilization of the luminaire (CU) — effect of space dimensions and finishes on light received at the desk top.

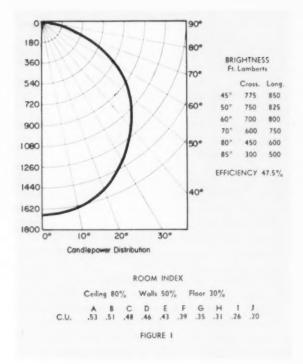
If, in addition to the laboratory report, the engineer is given the luminaire price, he can analyze the building lighting costs. He also can make a physical inspection of the luminaire to determine gage of metal, type of auxiliaries and components, mounting method, general construction, and quality of finish, and then recommend a course of action to the owner based on these considerations.

Architectural features such as appearance, modular conformity, and artistic harmony have become increasingly important and cannot be ignored. Certainly, the responsible engineer will not argue with an architect over appearance or artistic harmony. However, if a special luminaire must be designed to satisfy a peculiar module, lighting costs no doubt will increase. It is then the engineer's duty to bring this increase to the owner's attention — with a factual explanation.

Reciprocity is the owner's private business, but an engineered lighting system begins with luminaire selection, and its design cannot be considered simply the application phase for a preselected luminaire. The benefits of engineered lighting are largely the result of proper luminaire selection. At this point, the economics of the final installation are established as well as the quality (brightness control). The mechanical application of the luminaire to a physical layout, while time consuming, is of secondary importance.

The intense competition between luminaire manufacturers, together with very sharp bargaining on the part of building owners, has had mixed results in the lighting field. Our economy is based on competition, and we cannot decry it. However, in the lighting industry, today's competition is unhealthy. Prices have been driven down to a level where quality is almost sure to suffer. It is now possible to buy superficially similar luminaires at prices varying as much as 100 percent. Under these circumstances, the buyer must be wary of materials, workmanship, and design, for they will vary widely.

Evaluation of some specific examples will indicate just how luminaire selection affects ultimate building costs. Assume an office building of one million rentable square feet and 36-stories high. Set back construction is such that the first 15 floors represent half of the rentable space. The building is to have a minimum maintained level of illumination of 50 foot-can-



dles in the rentable space. This is to be provided by a building standard recessed fluorescent fixture.

In order to simplify and reduce the number of calculations we shall assume an average room index F of 1.5, and the following reflectance values: ceilings 80 percent, walls 50, and floors 30. Further, we shall assume 480/277 volt service provided by two transformer banks, one located in the basement and serving the first 15 floors, the other located at the 24th floor and serving floors 16 through 36. (Use of 416/240 volt service would produce similar results.) Also, two air conditioning compressor installations are assumed to be located on the same floors as the transformer banks and serving the same floors as the transformers.

#### Data and Calculations for Case 1

Assume that the owner has selected a building standard luminaire. The distribution curve, brightness data, and CU are shown in Fig. 1. It is a 2-ft by 4-ft, 4-lamp, rapid-start unit, with formed, one-piece, thin plastic diffuser, fully recessed. Its unit cost is \$30.

The consulting engineer has prepared a preliminary lighting design to determine the total number of luminaires required, the electrical load involved, and the air conditioning system needed for the lighting load. Total number of luminaires required:

$$A = (E \times R) \div (B \times L \times CU \times MF)$$

Where: E = illumination in foot-candles; R = rentable floor space in square feet; B = the number of lamps per lighting fixture; L = the light output per lamp in lumens; CU = average coefficient of utilization = 0.39; MF = maintenance factor = 0.70

 $A = (50 \times 1,000,000) \div (4 \times 2800 \times 0.39 \times 0.70)$ 

=16,383 luminaires

= 1 luminaire per 61 sq ft

Lighting costs (3 luminaires per outlet) are:

Cost of luminaires ....  $16,383 \times $30 = $491,490$ 

Luminaire installation .  $.16,383 \times $16 = 262,128$ Luminaire outlets . . . . .  $5,461 \times $22 = 120,142$ 

58.979

Lamp cost .....  $16,383 \times 4 \times \$0.90 =$ Total installed lighting cost \$932,739

Lighting electrical load:

 $= (16,383 \times 180 \text{ watts/luminaire}) \div 1000$ 

= 2949 kw

= 2.95 watts per sq ft

Lighting air conditioning load:

= 2949 ÷ 3.51 (kw/ton of refrigeration)

= 840 tons of refrigeration

Cost of air conditioning for lighting:

 $= 840 \times \$1000 = \$840,000$ 

Lighting electrical service costs:

Estimated ......\$62,100

Air conditioning electrical service costs:

Estimated ......\$12,900

In addition, the consultant has determined the annual electrical energy costs for lighting and the attendant air conditioning based on:

¶3120 operating hours per year for the lighting.

¶ 1000 operating hours per year for the related air conditioning over a 5 month period.

¶ 1.0 kw per ton of refrigeration.

An energy charge of \$0.0115 per kwh.

¶ A demand charge of \$1.60 per month per kw.

These annual electrical energy costs are:

Energy charge — lighting:

 $2949 \times 3120 \times \$0.0115 = \$105,810$ 

Demand charge - lighting:

 $2949 \times \$1.60 \times 12 =$ 56,621

Total charge — lighting: 162,431

Energy charge - air conditioning:

 $840 \times 1.0 \times 1000 \times \$0.0115 =$ 9,660

Demand charge — air conditioning:

 $840 \times 1.0 \times \$1.60 \times 5 =$ 6,720

16,380 Total charge — air conditioning:

Annual maintenance costs for the lighting system complete the consultant's calculations. These costs, based on a rate of \$0.15 per month per lamp, are:

$$16,383 \times 4 \times \$0.15 \times 12 = \$117,958$$

These data are summarized in Column 1 of Table 1.

#### Data for Case 2

The building owner left selection of the luminaire entirely to the engineer. The engineer, after investigation, recommends a 2-ft by 4-ft, 4-lamp, rapid-start luminaire with low brightness glass lens mounted in a hinged door. The luminaire is fully recessed, and its cost is \$45. Photometric data of this luminaire are

shown in Fig. 2. The building owner asks the engineer to develop the same information as in Case 1. The results are summarized in Column 2 of Table 1.

#### Data for Case 3

The building owner is delighted with the cost information developed in Case 2, but he has a connection with a lighting manufacturer who advises that he can furnish substantially the same luminaire for \$40. The owner is very interested in this additional saving and asks his engineer to study the luminaire. The engineer examines a sample luminaire and finds it similar to the fixture recommended. The engineer secures photometric data from the manufacturer who has had his fixture tested by a photometric testing laboratory. These data are shown in Fig. 3, and the figures developed by the engineer are in Column 3 of Table 1.

#### Data for Case 4

The building owner is attempting to reduce cavity space to a minimum and specifies a very shallow luminaire. It is a 2-ft by 4-ft, 4-lamp, rapid start unit, with

formed thin plastic diffuser extending somewhat below the ceiling, and it costs \$37. Fig. 4 provides the photometric data, and the results developed by the engineer appear as Column 4 on Table 1.

#### Comparison of Lighting Systems

An analysis of the costs shown in Table 1 reveals results which are startling to the uninformed. Several conclusions may be drawn from these data. Since Cases 1 and 2 represent the extremes in this situation, only these two will be discussed in detail.

¶ Initial cost of the luminaire is of little importance. It may vary within wide limits. A high initial cost accompanied by a high coefficient of utilization may prove quite economical. If the \$45 luminaire of Case 2 had been priced at \$52 the total installed luminaire cost still would have been less than that of the \$30 luminaire of Case 1. The difference in CU in Cases 1 and 2 is 15 percentage points. The total installed luminaire saving is \$83,199.

¶ On an annual cost basis, initial luminaire cost becomes almost unimportant. The annual saving of Case

		\$932,739 \$849,540 \$946,973 \$948,146 — \$-83,199 \$+14,234 \$+15,407 2.95 2.13 2.55 2.67 2949 2126 2547 2669							
tem	Basic Data	_				-		_	-
1 1	Rated lumens per luminaire	11	200	11,20	0	11,2	200	11,20	00
2	Lamp life, hours	75	00	7500		7500	0	7500	
3 '	Watts per lamp	40		40		40		40	
4	Watts per luminaire (including ballast)	18	0	180		180		180	
	Efficiency, percent	47	.5	61.5		54.5	5	53.0	
6	Coefficient of utilization, CU (assume F average)	0.3	9	0.54		0.45	5	0.43	
	Maintenance factor, MF	0.7	70	0.70		0.70	)	0.70	. 0
8	Luminaire cost	\$3	0	\$45		\$40		\$37	
9	Number of fixtures required	16	383	11.81	0	14,1	148	14,83	80
9a	Square feet per fixture	61		85		71		88	
0	Total luminaire cost	\$4	91,490	\$531.	450	\$56	5,920	\$548	,710
1	Luminaire installation cost			\$188.	960	\$22	6,368	\$237	,280
2	Outlet installation cost	-		\$ 86.	614	\$10	3,752	\$108	,768
3	Lamp cost			\$ 42.	516	\$ 5	0,933	\$ 53	,388
4	Total installed luminaire cost	\$9	32,739	\$849.	540	\$94	6,973	\$948	,146
4a	Installed cost difference from Case I		_	\$-83,	199	\$+	14,234	\$+1	5,40
5	Lighting, watts/sq ft	2.5	95	2.13				2.67	
6	Lighting electrical load, kw	29	49	2126		254	17	2669	,
7	Air conditioning load for lighting, tons of refrigeration	84	0	606		726	,	760	
	Lighting air conditioning cost	\$8	40,000	\$606	000	\$72	6,000	\$760	,000
9	Electrical service costs, lighting	5	62,100	\$ 43	500	\$ 5	53,000	\$ 55	,900
0	Electrical service costs, air conditioning		12,900	\$ 9	100	\$ 1	1,100	\$ 11	,600
11	Total installed cost (items 14, 18, 19, 20)		.847.739	\$1,50	8,140	\$1.	737,073	\$1,7	75,64
lla	Total installed cost savings over Case I		_	\$ 33	9,599	\$	110,666	\$	72,09
22	Lighting electrical energy cost/year	\$	162,431	\$ 11	7,100	\$	140,288	\$ 1	47,00
23	Annual maintenance cost	5	117,958	\$ 8	5.032	\$	101,866	\$ 1	06,77
4	Air conditioning electrical energy cost (1000 operating hrs/year in 5 months)	5	16,380	\$ 1	1,817	\$	14,157	\$	14,82
25	Annual owning cost of lighting system, 15% of items 10, 11, 12	5	131,064	\$ 12	11,054	\$	134,406	\$ 1	34,2
6	Annual owning cost of air conditioning system for lighting, 10% of item 18	5	84,000	\$ 6	008,08	5	72,600	\$	76,00
27	Annual owning cost of electrical service for lighting, 10% of item 19	5	6,210	\$	4,350	\$	5,300	5	5,59
28	Annual owning cost of electrical service for air conditioning, 10% of item 20	\$	1,290	\$	910	\$	1,110	\$	1,10
29	Total annual cost of lighting system (items 22, 23, 24, 25, 26, 27, 28)	\$	519,333	\$ 40	00,863	\$	469,727	\$ 4	85,5
30	Total annual savings over Case I		-		8,470	5	49,606	5	33.7

2 over Case 1 is \$118,470. The only variable being considered is the luminaire cost; thus, this annual savings represents an installed luminaire cost differential of \$789,800. Since number of luminaires, outlets, and lamps remain constant, this total amount may be

300 804 600 BRIGHTNESS 70 900 Cross, Long 900 1100 1200 60 50 700 800 1500 350 625 60° 70° 250 425 1800 80° 300 300 85° 350 250 2100 EFFICIENCY 61.5% 2400 40 2700 3000 104 209 Candlepower Distribution ROOM INDEX Ceiling 80% Walls 50% Floor 30% FIGURE 2

charged against luminaire cost. This equals \$67 per luminaire. Therefore, the building owner could have paid \$112 for the luminaire in Case 2 without exceeding the annual costs of Case 1. This represents a 267 percent price increase over the basic \$30 figure.

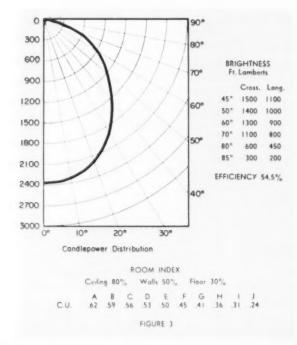
Savings in installed air conditioning costs are of great significance when more efficient luminaires are employed. This dividend should be considered carefully and developed during engineering design.

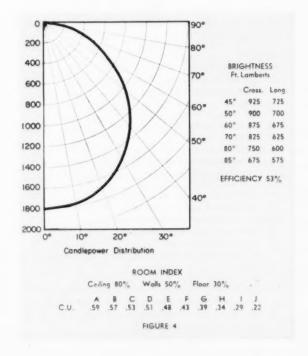
¶ Energy costs and maintenance costs vary as the number of luminaires. Substantial savings can be secured with high efficiency luminaires.

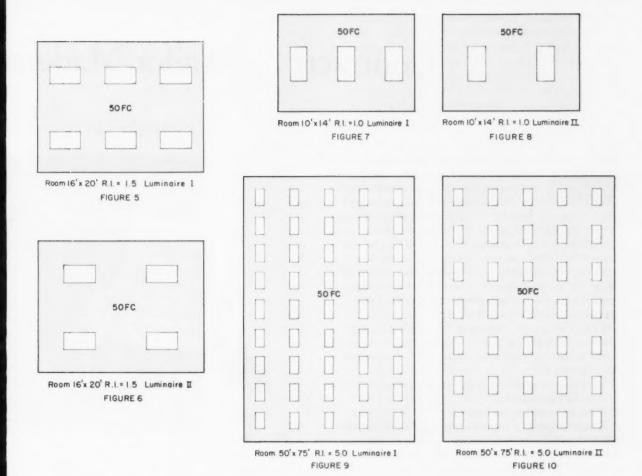
Figs. 5 through 10 reveal the advantages of Case 2 over Case 1 in three typical rooms. Note that reduction in number of luminaires also improves the ceiling appearance of the room.

¶ An analysis of the photometric data in Figs. 1, 2, and 4 indicates that the low brightness lens of Case 2 is, in fact, low brightness. The brightness in the viewing angles above 45 degrees is lower than Cases 1 and 4. This provides more seeing comfort (higher quality) to workers in the area and at the same time directs more illumination to the working plane, thus securing greater light utilization.

¶ This comparison of luminaires is based on equal levels of illumination, i.e., 50 foot-candles. It was pointed out that Case 2 provides a higher degree of visual comfort than any of the others. It is a well established axiom of illuminating engineering that as luminaire brightness increases in the viewing angles above 45 degrees the effective illumination on the working plane







(in office applications) decreases. The net result is that a higher illumination must be provided to offset to some degree the visual discomfort due to luminaire brightness. Therefore, the situation presented for Cases 1, 3, and 4 is optimum. In reality, the effective illumination is less than Case 2.

The photometric data of Fig. 3 indicate that the substitute luminaire of Case 3 has been improperly designed from a quality standpoint. The lens characteristics have been greatly altered as indicated by the very high brightness above 45 degrees. The result has been a reduction in utilization of light and reduced seeing comfort. This substitution would result in a substantial increase in both initial cost and annual cost over Case 2.

It should be borne in mind that these statistics apply only to the luminaires described. However, the approach is universally applicable and can be used on any project. The information from such a study is well worth the time and money required. The selection of the luminaire is made for reasons of quality and economy which have been developed by engineering investigation. The resulting lighting design is a credit to the engineer and a dividend to the owner. More than this, it produces a highly acceptable working environment which is its prime purpose.

Engineers often complain that the building owner dictates the basis of design and certain of its components. The engineer's opinion may not be asked, and often the owner has selected the luminaire before the engineer begins work on the details of design. However, if the engineer accepts these restrictions without question he becomes a party to them. It is his duty to present an appropriate cost analysis to the owner before he accepts such decisions.

Good engineering presupposes a thorough knowledge of all aspects of building design. The owner has the right to refuse the engineer's recommendations, but no engineer has the right to withhold them when, in his opinion, they will benefit the owner. Obviously, the owner should be more concerned with getting an economical building than with getting low cost engineering. A luminaire selected on other than an engineering basis may compromise later design.

#### Contracts . . . Tailor-Made o

GEORGE LEVIN, Consulting

CONTRACTS for engineering services in older con-

CEexclusive

sulting engineering firms usually have grown phrase by phrase, and clause by clause. They are, in fact, a com-

pilation of the troubles the firm has had, or heard about, through the years. They are not based on established rules or simple check lists. Thus, for the newer firm, the contract for engineering services is often a matter of opinion rather than fact. Certainly, there are excellent standard forms available, but there forebear from doing something. But, this definition is so general it is practically useless.

Legal opinions on contracts for engineering services are the province of the attorney, but there are some basic questions which the consulting engineer should consider:

¶ What is the contract for engineering services?

Why do you want one?

¶ What purpose does it serve?

Simply defined, a contract is a legally enforceable agreement between two or more persons to do or to forebear from doing something. But, this definition is so general it is practically useless.

For more precise information, I asked an attorney for a legal definition of a contract. His definition took up two pages — thus proving beyond all possible doubt that it is a legal definition.

Here is what the attorney said:

"A contract is a promise, or a set of promises between two or more persons to create, modify, or destroy a legal relationship, and for the breach of which the law gives a remedy, or the performance of which the law in some way recognizes a duty. A promise is an undertaking, however expressed, either that something shall happen or that something shall not happen in the future.

"A contract is created when the following six essentials appear:

¶ "Offer and Acceptance — There must be a distinct communication by the parties to one another of their intentions. An offer must be a clear and explicit premise, and an acceptance of such an offer must be absolute and unconditional.

¶ "Capable Parties — The parties to a contract must be capable, in law, of making a valid contract.

¶ "Genuine Consent — The offer and the acceptance must have been made with the intention of changing



the legal relations of the parties by creating legal rights. The principal causes for unreality of consent are: mistake, misrepresentation, fraud, duress, and undue influence.

¶ "Consideration — The contract must be supported by a legal consideration, and under ordinary circumstances, each party to a contract must contribute something to it.

¶ "Legal Object — The object of a contract must be legal. It is illegal if it violates a recognized law, or if it is contrary to public policy.

¶"Legal Form — The contract must have the form required by law; however, all contracts are proper as to form regardless as to whether they are oral or written, or partly oral and partly written, unless the law specifically requires that the contract for this agreement shall be in writing.

"A contract may be terminated in the following ways: by agreement, by performance, by breach thereof, by impossibility of performance, and by operation of law.

"In general, the rights and obligations under a contract are those created by the parties themselves. The contract will be interpreted or construed by a court

#### tandard Form?

ngineer



only to arrive at the real intention of the parties. It will continue in operation until completed or terminated as indicated above."

At this point, you know why you need an attorney, even if you do not know why you want a contract. Why do you want it? The main reason is simply that you want to start work. But this contract, this agreement, does not have to be written — it can be oral or only partially written, and still be legally binding. So what you really want is to arrive at an understanding with the owner. After you and the owner reach this understanding, and are in agreement, it will not be hard to produce a clear and complete written contract with the aid of an attorney.

While it is necessary, eventually, to reduce the arrived-at agreement to writing, for the protection of all the persons involved in the agreement, I believe that the most important factor has to be that such an agreement is arrived at between two honorable men. It is beyond my understanding how your client could retain you if he did not feel that you were an honorable person. Conversely, I do not see how an engineer could work to professional and ethical standards for a man he felt was dishonorable in his intentions

at the time of agreement. There is no doubt that one can be fooled, and I suppose that is the price we pay for experience. On the other hand, if the intentions of the parties are not honorable, there is no contract that will force them to do what they never intended to do—without a great deal of time, effort, and money being expended to force compliance.

A contract, then, is an agreement between two or more persons to do or to forebear from doing something. Contracts for engineering services usually involve doing something, rather than not doing it. The contract that you tender to your client says that you will do something. The big question is: When you do engineering, what is that something that you describe in the contract?

I think it best to state what you propose to do in a forthright manner. What you propose to do may not be completely satisfactory to your client, but at least it will not be misunderstood. As a young lady once pointed out, "Although they both lead to the same thing, there is a big difference between a proposal and a proposition." One of the differences is the manner of presentation. It is your move, your initiative, and therefore, you must say what you, as the consulting engineer, propose to do. Just for good measure, you add what you propose not to do. Of the two things what you are going to do and what you are not going to do - I think that a frank statement of the latter is the most important in establishing a pleasant relationship between engineer and client. It might be well to discuss what you normally undertake as part of the contract for engineering services in its broadest aspects, so that it will apply to diverse situations. You propose to act in your client's best interests, as a prudent and knowledgeable person; and to fulfill his particular requirements, in a manner suitable to his needs. For the effort expended, you expect to get paid.

To the extent that your client's requirements are vague, you can only state what your efforts will be in broad terms. To the extent that his requirements are specific, your efforts may be stated in specific terms. Much depends upon how well you know your client, his business, and his needs.

I have no written contracts with clients for whom I do purely consulting work, for I feel that to act purely as a consultant, as distinguished from design work, the trust must be placed in me, and I must respond in a professional manner. Whoever heard of a contract for acute appendicitis? When you go to a doctor and you say, "I've got a pain in my belly," the doctor doesn't say, "Well, sign this contract." He says, "Hmmm!," and then he tells you what to do and expects that you will do it — and he expects to be paid for his advice.

Possibly you have heard the story of the mechanic who was called out to fix a stalled car. He opened the hood and looked at the engine. Finally, he went back to his truck and picked up a four-pound sledge. Returning to the engine, he gave it a mighty blow. Thereupon, the engine started, and when the owner said, "How much?," the mechanic said, "Five dollars." The owner protested, saying, "Five dollars for hitting my car with a hammer?" The mechanic said, "Sir — the charge is only one dollar for hitting your car — it is four dollars for knowing where to hit!"

#### Be Specific

In general, you are going to perform the necessary engineering services for a project or a portion of a project. Thus, you can be quite specific about what engineering is required. It is important that a clear-cut statement of what you expect to give, and what you expect to get, be made during the course of preliminary discussions. After these things have been agreed to verbally, they can easily be reduced to writing. When you state what you propose to do, you must avoid ambiguous phrases and vague statements. You must avoid the hope that what is left unsaid will work out okay. Remember Murphy's Law — if it can possibly happen, it will.

Usually, any ambiguity in a contract is construed against the writer of the contract. Last year you heard a number of ambiguous statements made during the political campaigns, and this year during the change of administration. Contrast these to General William Sherman's statement in the post-civil war period: "If nominated, I will not run. If elected, I will not serve." Or Calvin Coolidge's statement, "I do not choose to run." It is rather difficult to misunderstand either of these statements.

There naturally are some differences between contracts with laymen and contracts with other professionals. In contracts with other professionals, either may be the initiator of the contract; and professional, engineering, and technical terms may be used. Usually in contracts with laymen the engineer is the initiator, the proposer, and the writer.

In fact, the owner really does not want a contract, a design, advice, or engineering. What he really wants is a going plant. He wants it furnished, installed, and ready to operate when he pushes a button. Usually, the engineer is asked to proceed with the design and then, on the engineer's initiative and action, the agreement is formalized. The engineer must tell what he is going to do, when he is going to do it, what he is to be paid for the work, and when or in what manner he expects to get paid. All of these points are open to negotiation, as would be the case in any contract, and it is up to the engineer to accept or reject, in positive terms, any counteroffers.

Nothing is wrong with accepting a counteroffer. There is no magic in the form of a contract such as that developed by Consulting Engineers Council — only some convenience. In any event, a frank discus-

sion of the matter will make the owner and the engineer happier, for both will know what to expect.

The CEC forms are all about the same, except for the difference between those for the lump sum fee and the percent of the construction cost fee. It is my personal preference to write a contract in which the fee is a lump sum. I have found that most businessmen prefer to deal with a specific amount of money. Also, from his professional experience, the consulting engineer should be capable of determining, within a few dollars, what the job will cost him to produce, what expenses he will have because of a particular client or particular location involved, and what profit he wishes to make. Adding these together should result in an accurate lump sum fee.

When the fee is a percent of the construction cost, the engineer - upon determining that a more costly item is necessary for the proper design of the project - is influenced by the fact that the decision also affects his fee. It is my opinion that the cost of producing a job is not determined as much by the project cost, as by the type of project, the possibility of using repetitive or previous designs, both geographical and geological location, and, in particular, the client - for some clients are considerably more demanding than others. A percentage fee cannot take all of these items into account any more successfully, or less successfully, than can a lump sum fee. The same engineering effort will be involved in a job, whether a contractor bids 10 percent high or 10 percent low. Usually, the fee is determined by taking into account past experience. This could as easily be presented as a percentage as it could a lump sum - but businessmen prefer to deal in dollars.

When businessmen deal in dollars, they know the value of their risk. All enterprise involves some risk. The consulting engineer has to realize that he is in business, and that he, too, has to take some risk. To the extent that he knows his own costs, he lessens the risk of producing the job without profit. Neither a percentage fee nor a lump sum fee will help him if it costs more to do the work than he contracts to receive for it. There is nothing in the contract that says the owner must guarantee the engineer a profit for his work. The engineer has to be a businessman when he assumes a contractual relationship.

#### Say It Right

Engineering projects may vary so much that it is a question of whether one wishes to say: "The engineer shall prepare all required schematic drawings, layouts, flow diagrams, studies, reports, and a construction cost estimate based upon the diagrammatics," and further, "The engineer shall supervise the making of all required subsurface explorations, make the necessary topographical surveys for design purposes, and prepare preliminary drawings, outline specifications,

and a construction cost estimate based upon the preliminaries," or whether it is better to simply say: "The engineer will do whatever preliminary engineering is necessary to the job at hand." A professional is the only one who can determine the professional requirements of this portion of the work.

A completely different situation exists when you are dealing with another consulting engineer or an architect, for they are professionals and really do not want all of your services — only some of them. Thus, they may be specifically listed. When dealing with professionals, you are going to use professional terminology, but when you are dealing with laymen, there is no need to define the practice of engineering any more than there is need for the doctor to define the practice of medicine to his patients. The doctor says he will do his best, and the engineer should say the same. As the project develops and information becomes available, the question of what is best may change.

"It seemed like a good idea at the time." This describes the whole process of preliminary engineering up to the point where action can result either in proceeding with or abandoning the project. I do not see any point in describing to the owner, in the agreement, all of the agony that I am going to go through to produce the desired result. Frankly, I do not think he cares. He is willing to pay for the result, but he is not willing to pay for the agony.

There are some types of work required by one professional of another that cannot be handled except on a time basis. Usually, this is true when the project has not been so fully developed that the work can be thoroughly outlined, or where time of completion is so important that it makes it necessary to overlap functions that normally should follow one another. For example, we recently asked for professional services from another consulting firm. They sent us a contract which read:

"We will furnish requested engineering services for the above named project on a cost plus time and material basis, at our standard hourly rate of \$XXX per hour. Printing of plans and specifications, transportation, and miscellaneous expense will be charged at our net cost.

"On the basis of the foregoing, we will, when directed by your office, provide all required supervision and inspection of the installation as necessary to enforce compliance with the plans and/or specifications. We will also provide all necessary checking of shop drawings on the same basis."

Here is a perfectly agreeable contract between two professional people. I will call upon the other engineer for his help, and he will supply what he deems necessary. The charge will be on a basis of time spent. There is really no need for further detail.

Sometimes it is impossible to know either what is required or what it will cost when a project is first presented. This occurs when a client simply describes the results he seeks to achieve. For example: "What will it cost for a plant to convert oatmeal back into oats?" Well in the first place, you do not know if it can be done, either technically or economically; second, you do not know what equipment will be required, because it is obviously a new and different requirement. Yet, you may be the person most logically able to give an answer — if there is one.

When such situations are proposed to me, I usually answer in this fashion: "In the first place, I do not know the answer to your problem, but I might possibly be able to develop one. It will cost you a certain amount for my time and effort to find out whether it is worthwhile to proceed further. If you wish, I will work on the project, to the extent that I will bill you for my time and expenses, not to exceed a given amount. At that time, I will tell you what my fee will be to bring you to a point where we will be able to determine the cost of the project, or the technical or economical infeasibility. If it proves feasible, and you wish to proceed with the work, we will then determine what the cost for engineering services will be to design such a project."

I have never found any opposition to this type of arrangement, except by those who were probably looking for a quick answer at no cost to themselves.

#### Accentuate the Negative

In dealing directly with a client or owner on a contract for engineering services, I think it is more important to state what you will not furnish, or what you do not consider included in your engineering, than what you normally include. Although the CEC contract form includes the supervision of all required subsurface explorations, it does not precisely state that the owner will pay for the soil borings and soil tests. I do not mind supervising the soil borings to the extent of pointing out where I want the holes, but I insist that before I undertake a project, the owner provide me with soil borings and soils tests satisfactory to me, or authorize me to proceed with the same for his account.

This, of course, helps to determine some of the requirements of the job. It is more difficult to engineer a job which is on piling or which requires piling than one which does not require piling. It is even more difficult if the conditions are such that it lies on the dividing line and you must run through both calculations to determine which type of construction will be the most suitable and economical. Then, too, a request for soil borings requires the owner to spend some money immediately on the project and, in a sense, determines whether his interest in the project is genuine or whether it happened to occur to him that morning while shaving. It is amazing how much preliminary lost time can be saved by simply saying, "Well, the

first thing you need before I can say anything is three test borings, which will cost you about \$300 per hole, or about \$1000."

When a client asks for engineering services, he mentally includes almost everything that is involved in getting his project completed. This is not an unusual viewpoint, and probably is the one you adopt when dealing with a doctor or an attorney. Therefore, the engineer must take particular care in drawing the boundaries for the services that he intends to provide for the project. It is most important that the things he does not intend to provide be stated directly and specifically. Usually, the engineer does not provide for surveys, soil tests, out of town transportation and expense, long distance telephone and telegraph, and work of special consultants, such as metallurgists, gas analysts, and attorneys.

The engineer usually provides what I call general engineering supervision and inspection, but he does not provide supervision in the manner nor to the extent that the owner thinks of supervision. This is an area that must be most closely defined. The Consulting Engineers Council form says: "The engineer shall provide general supervision of construction to insure general compliance of the contractor's work with the drawings and specifications, and shall endeavor to protect the owner against defects and deficiencies in the work of the contractor, but he does not guarantee the contractor's performance."

The American Institute of Architects states: "The architect endeavors to guard the owner against defects and deficiencies in the work of the contractors, but does not guarantee the performance of their contracts. The supervision of an architect is to be distinguished from the continuous personal superintendence to be obtained by the employment of a clerk of the works."

Usually, I say, "to furnish general engineering supervision of construction (but not full time nor detailed supervision), to insure general compliance of the contractor's work with the drawings and specifications, and to endeavor to protect the parties against defects and deficiencies in the work of the contractors, but this in no way guarantees the performance of the contractors. It must be noted that this supervision is a matter of being available for communication, although periodic inspections of the site will be made, and does not intend to represent being in physical control or direction of the operation on the site."

The only way to insure full and complete compliance with the specifications and drawings is to employ an honorable contracting firm. There is no team of inspectors that could compete with a contractor who wished to do a dishonorable thing. He could simply create a diversion by asking questions at one end of the job, while he did his intended dirty work at the other end of the job. A careful study of a contractor's reliability and capability is well worthwhile.

#### Reach an Understanding

To have a satisfactory contract for engineering services, you must have an honorable client and deal honorably with him to reach an understanding, which may be put into proper written form with the aid of an attorney. You must think about what you intend to give and get, and state both frankly.

The understanding, or agreement, will cover as simply as possible the fact that you will act in the owner's best interest, in a professional manner, providing all of the engineering talent you deem necessary to produce the desired result. So that there will be no doubt, the agreement will be specific about those services you intend to limit or not furnish at all.

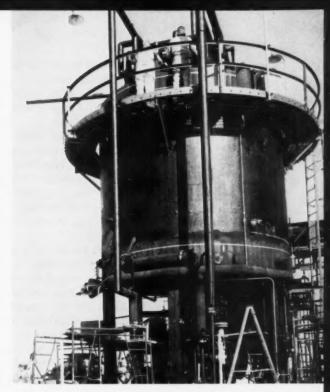
The understanding will cover the amount of your fee, how you arrived at it, and how it shall be paid. Services or things which may be billed, in addition to the fee, shall be brought to the client's attention.

As in many things, one learns from experience and pays for it. If you have been a good businessman, figured your costs carefully, and did not contract to sell your services too cheaply, you will find the agreement easy to live with. A contract that you have thought about and tailored to the particular client and job at hand will be a far more satisfactory contract than will a standard form.



# Can We Afford Water From the Sea?

RAPHAEL KATZEN, D.Ch.E Consulting Engineer



Melter-washer tower of OSW St. Petersburg plant will convert salt water to fresh by freezing process.

RECENT YEARS have seen marked advances in the

Cp exclusive

science and technology of recovering potable waters from saline sources, both brackish and sea water. The gov-

ernment sponsored program run by the Office of Saline Water of the Department of Interior has accelerated research and engineering development in this area. Most recent information would indicate, however, that the political pressures on this officially sponsored program may have prematurely forced design and engineering of large scale installations while research efforts were still in a development stage. It begins to appear that the several so-called demonstration plants to be set up under the government sponsored program will be obsolete by the time they are put into operation.

At present, the OSW is operating on a \$20 million budget, and it may well be that an equal amount will be forthcoming. Hidden beneath the surface of the stream of support for this program are those elements which could greatly affect a number of utility interests in load building, area development, generation plans, and greater political influence.

It is difficult to separate political necessities from practical requirements, but it seems that much of the money being appropriated and expended for large scale demonstration or pilot facilities could bring much greater long term returns if put into basic scientific and engineering research toward radically new approaches to water desalinization. There is some money allotted for such research, but the amount is small compared to the need.

#### Currently Operating Desalinization Plants

The operation of the five demonstration plants which have received so much publicity during the past two years will be based on scientifically well established processes, which are:

¶ Forced circulation multiple effect evaporation

Multistage flash evaporation

¶ Electrodialysis

¶ Vapor compression distillation

Freezing

#### **Desalinization Costs**

Although fundamentally sound, these five processes still require appreciable engineering development to achieve more economic operation on the large scale required for future industrial and domestic operations. The problem of cost of sea water desalinization has been described very well by G. E. Sonderman.<sup>2</sup>

Many claims were made, prior to the date of Sonderman's publication, that water could be produced for much less than \$1.00 per thousand gallons, and additional claims along the same line have been made since. There is one large scale installation operating today in which costs are said to be below \$1.00 per thousand gallons, but the accounting method has not

been divulged.<sup>3</sup> As pointed out by Sonderman, when all charges are considered, including amortization, maintenance, interest on capital, auxiliary services, storage, and transportation of water, the general claims of low cost quickly inflate to levels substantially above current costs for underground and surface water.

It should be emphasized that the five demonstration plants are not expected to achieve costs below this critical \$1.00 per thousand gallon level. In an attempt to penetrate the smoke screen of cost estimates, OSW has set up an arbitrary, but realistic, accounting method which is receiving general acceptance as a standard for comparison.

Although there may be specific areas in the world, and particular emergency conditions such as those associated with military requirements, which might stand a cost of more than \$1.00 per thousand gallons, the long-range, large-volume development for water desalinization requires processes that will produce water at considerably lower cost levels. The higher cost municipal water available today runs \$0.50 to \$0.60 per thousand gallons and may be expected to increase in the future. However, we are considering current comparisons, and there are only a moderate number of locations in which the users can, or will, pay the high price for desalinized water. It is indicated that large scale desalinization installations today cannot yield water for a real cost of less than about \$1.50 per thousand gallons.

#### **Potential Desalinization Processes**

All of this adds up to the conclusion that radically different processing methods are required which will be more efficient than current thermal and electrical processes, both in investment and energy consumption.

Solar evaporation is one obvious alternate, as the energy is free. However, the very substantial investments required for large volume solar evaporation facilities create fixed charges far in excess of the equivalent energy savings. Technology in this area is developing slowly, but only by radical departures in methods of radiant energy concentration can we expect to achieve more reasonable equipment sizes for the evaporation loads anticipated. Relatively speaking, however, only a very small amount of money is going into research in this area, where there is the potential for a considerable improvement in technical efficiency and economy of operation.

B. F. Dodge<sup>5</sup> has published an excellent review of the problem of engineering research in the saline water field. He points out a number of unusual phenomena that could be used for desalinization processes. These include:

- Sublimation of salt
- Adsorption of salt on solids
- Thermal diffusion
- ¶ Ultrasonic vibrations

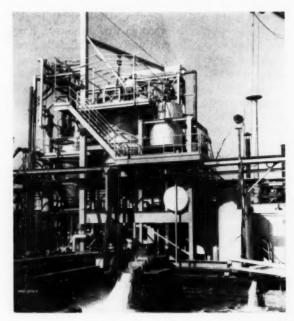
- ¶ Underwater combustion (with a distillation process)
- ¶ Ion repulsion at water-oil boundary
- ¶ Selective solvent for salt
- ¶ Electrolysis
- ¶ Streaming potential
- ¶ Electrostatic effects
- ¶ Electromagnetic effects
- Ultra high-frequency current

In substantially all of these suggested methods, the basic scientific data is available, but engineering technology for large scale operations is lacking. Some of the suggestions, involving techniques of the electrical engineer, the chemical engineer, and the mechanical engineer, require investigation along lines and on a scale not contemplated previously by investigators in these areas. For example, the applications of streaming potential, electrostatic effect, and electromagnetic effect to the separation of dissolved salts in saline waters have not been investigated on any appreciable engineering scale.

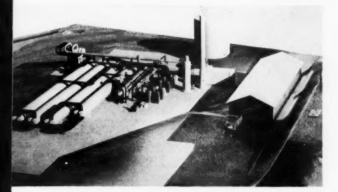
#### Desalinization by Freezing

The kind of thinking required to develop such programs, however, is indicated by recent developments stemming from investigation of the fairly conventional method of freezing to accomplish the separation of water from salt.

Whereas the processes normally contemplated for such operations involve actual freezing of saline water, with washing of adhering concentrated brine from the frozen water crystals, more advanced techniques have been developed recently along lines in which



Wrightsville, North Carolina plant produces 15,000 gpd.



San Diego OSW plant uses multistage flash distillation. The plant, under construction, will produce 1 million gpd.

liquid refrigerant is added to the saline water directly, yielding very fine ice crystals from which the brine is more readily separated. But this process does appear to yield subsequent problems, one of which is hydrocarbon hydrate formation.

#### **Possible Solution**

This problem in turn has suggested another process recently disclosed in a paper by W. G. Knox, of the Koppers Company, given at the AIChE meeting, in Washington, D. C., December 1960, and described in U. S. Patent 2,904, 511, by W. E. Donath.<sup>6</sup> In this process, a liquid hydrocarbon is used which will specifically form a hydrate with water, separating the relatively pure water in the hydrate from the briny residue. By segregating the hydrocarbon hydrate, and then rewarming it, relatively pure water is produced. The moderate temperature changes involved in this process and potential high efficiency in reclamation of refrigeration values would indicate an improved thermodynamic efficiency. This process has been carried out only on a small pilot scale, and will have to be investigated in a larger pilot operation before a full engineering and economic evaluation can be made.

In this instance, the engineering techniques required to achieve the very close temperature approaches and high refrigeration recoveries far outweigh the basic scientific problem of hydrate composition and purity. There also are the thought provoking problems presented to the engineer for solution in balancing endtemperature approaches in heat exchangers; determining insulation values and pressure drops for fluid streams through the heat exchangers and separation equipment; plus recovering of refrigerant more completely from the briny residue and from the pure water separated from the hydrocarbon hydrate.

It would seem that the large potential for thermodynamic improvement, and resulting reduction in both investment and operating costs, is so significant that much of the engineering and financial effort being expended to develop fairly conventional facilities would be far better used if diverted to such unorthodox approaches.

#### New Technology to be Explored

The problems here, as well as those involved in obtaining higher efficiencies and lower investment for the more conventional thermal processes, indicate the need for more cross fertilization of ideas among engineers in different fields of activity. For example, engineers in the cryogenic field have for decades worked with heat exchanger designs involving end temperature differentials of only a few degrees Fahrenheit. In this same field, maintenance of pressure drops at extremely low levels simultaneous with achievement of high heat transfer coefficients and mass transfer efficiencies, indicates that technology is available which could be translated to the saline water conversion area.

Perhaps the most intriguing challenge lies in the application of electromagnetic fields to the movement of ionized salts in solution. This is the next logical step from the electrodialysis development, which in turn is a considerable improvement over simple electrolysis. Critically lacking are energy data indicating the electromagnetic field requirements for movement and concentration of ionized salts in various saline solutions found in nature.

#### Improving Desalinization Efficiency

Most essential in any of the novel methods studied is a thorough analysis of limitations on thermodynamic efficiency of the water purification process. Dodge<sup>5</sup> and Hickman<sup>7</sup> have pointed out the large gap between theoretical and practical energy requirements. The most efficient sea water desalinization installations made to date have over-all efficiencies of less than 3 percent. Dodge indicates that an improvement to 10 percent should be feasible, but 20 percent would be most difficult to attain. Even though the percentage figures still appear low, such improvements could reduce energy requirements to 1/3 or even 1/6 of current levels, and operation-wise would be most attractive economically.

Herein lies the challenge to the engineer — one which seems to require many new departures in research and development.

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Architects and engineers need each other—but seldom are willing to admit it. Must they continue to practice apartheid?



#### The Concept

ARCHITECTURE, as a profession, is on the brink of

Cresclusive its greatest change in a half century.
This change is one which the profession has approached most slowly

and cautiously — and, in fact, has not yet truly accepted. It is a change in basic attitude toward the relationship between architect and engineer.

For the past 50 years, since the time of Dankmar Adler, a prominent Chicago architect, the engineer has occupied a position in architecture which bordered on second class citizenship. He was either a consultant, called upon by the architectural designer to supplement the designer's technological knowledge, or he was a member of a major firm of architects and engineers who always sat below the salt. Now, dietated by a growing awareness of the need for more creativity in the engineering phases of building design, and by an equal awareness of a lack of properly trained and qualified men, the profession is at last taking steps to make the engineer a part of the design team — to welcome him rather than merely tolerate him.

The engineer is often a man who is an architect in his own right, but whose abilities and talents lie more in the direction of design and execution of mechanical, electrical, and structural systems and functions than in the readily recognized building shell.

The start of this movement began more than 50 years ago when midwestern architects, particularly a Chicago group in which Dankmar Adler was prominent, became acutely aware that the civil engineers of the day were inadequately educated in structures as they related to buildings. These civil engineers had a sound foundation in many engineering fields. However, they were unable to understand the sympathy of the architect for his project, and as a result were inadequately translating the needs of his design into a consistently harmonious structure.

It was on this premise that Adler requested the University of Illinois to develop a curriculum which provided an education for those young men who were to integrate the complex structural design required by skyscraper construction with the newly created architectural concepts. The curriculum which resulted was the beginning of formal education in architec-

# of the Complete Architect

ROBERT F. HASTINGS, Smith, Hinchman and Grylls

tural engineering. It was believed this would attract young men principally interested in buildings, but whose greatest competence lay in structures.

At this time, the major design phases of buildings included the architectural shell and the structural framing system. The architects had been educated in the skills of space planning, arts and aesthetics, and handling of the building materials in use at that particular time. They had a broad general background in structural systems, but were not necessarily qualified to design such complex structures. Instead, they had to turn to civil engineers for this phase of building design. However, civil engineers, then as now, were trained in many fields of structure other than that of buildings. The civil engineer was the principal designer and received recognition for the work performed when he designed a bridge or a highway, but, at best, his services in structural design for buildings brought him recognition secondary to that of the architect.

For a time, other schools of architecture incorporated some structural education into their architectural curriculum, and the profession benefited. However, in recent years the curriculum problem has arisen again — in a different form but directly related to the problems that existed in 1900.

Today, the need for architects trained in the intricacies of mechanical and electrical design is as great as it was for the structurally educated 50 years ago. Yet, the colleges of architecture are not incorporating these new design requirements into their curricula, and, in many instances, are decreasing or eliminating the opportunity for structural education.

Within the colleges and universities themselves, educators point to the profession as being the father of the fault. Why, ask the engineering colleges, should we train structural, mechanical, and electrical engineers for architecture? Once they enter that profession, say the engineering schools, they do not receive rewards commensurate with their abilities. Where they are welcomed into other professions, they are given only moderate opportunity in architecture. Would we not, continue the engineering schools, be fulfilling our educational destiny more fully if we educated these men as engineers to offer them

the maximum opportunity, the greatest recognition? The architectural colleges give much the same answer. They believe that the profession primarily wants trained architectural designers.

It appears that we now are forcing all young men whose sympathy lies with buildings to become architectural designers, since the word "architecture" in the schools primarily means architectural design. It is generally agreed, however, that no more than five percent of practicing architects today confine their efforts to architectural design.

The complete architect of today, as the clients are coming to know him, is a well-rounded man who can translate the client's architectural needs in terms of architectural design; of mechanical, electrical, and structural systems; and of terrain and environment; as well as assist in financing and planning the client's future needs. Literally, the client expects his architect to understand the rudimentary structure of his business almost as well as he does himself. Therefore, it certainly seems illogical to attempt to create an architectural designer out of everyone who displays aptitude and desire to make building design his life's work.

Buildings today are complex machines. The design and execution of the structural, mechanical, and electrical systems of buildings play as great a part in creating the environment for the building's inhabitants as does the exterior shell. Yet, to achieve the total harmony which architecture must have, the varied skills of men trained primarily in architecture must never be lost. The architectural designer must be able to communicate his dream, his concept, to the structural, mechanical, and electrical designers just as these three specialists must convey their concepts to one another and to the architectural designer. Each must have a sympathy for the other's function. The result must be unity, not competition.

During the past 20 years the picture has shown two completely inverse spirals. Professionally, the demand for mechanical, structural, and electrical designers has multiplied, while educationally the trend has been to de-emphasize, and in many colleges eliminate, the opportunity for such schooling. Today most schools of architecture have dropped the term "architectural engineer." It is true that many such colleges have retained a structural option in their schools of architecture, but it is too often a watereddown course in structures. In part, it appears that the architect today is swimming blindly upstream, telling the world he is a generalist, while he turns more and more in the direction of the specialist.

However black the picture may appear, there are indeed sunbeams. The article "Bringing the Design Professions Together," by Philip Will, Jr., Consulting Engineer, January 1961, is a frank, forthright presentation of the problem. It is an open recognition by the past president of the American Institute of Architects of the need for a change in the thinking of his profession. His views appear to be extensions of The Report of the Committee on the Professions of the American Institute of Architects, issued in January 1960.

Nowhere will one find architects who will oppose the precept. All will admit the evils and give lip service to suggested cures. However, the cures must be administered in the operating room, not in the diagnostic chamber.

To present a fault is simple. To propose an efficient remedy is far more difficult. However, let us examine some remedies. First, let us look at the field of education. Here there appear to be few differences over one precept — that the leadership for education in all phases of building design lies within the colleges of architecture working hand in hand with the colleges of engineering. The colleges of architecture supplied a satisfactory solution a half century ago when they incorporated structures. Surely they are equally capable of expanding to include mechanical and electrical education. Too, the basic requirement of an architect is sympathy for buildings. One must never lose sight of this as the keystone ingredient. And there is no more direct route to the fulfillment of one's professional destiny, graced with this attribute, than through an architectural education.

This sympathy must be developed by initial impetus from a basic education in architecture. Without it, the individual will again fall far short of his potential. Thus, all students should receive an initial course, perhaps three years in duration, in the very fundamentals of architecture. Then would come the options. Certainly architectural design should remain dominant. However, it should not be the only door through which the student could pass. The options of mechanical, structural, and electrical design should be offered, for by now the student might have discovered direction and talent away from architectural design but still within the realm of buildings.

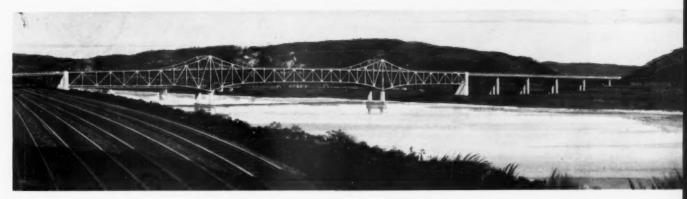
The student then would have completed a five, or perhaps six, year course. He would be in the true sense an architect, well trained in all fields, truly expert in one, and with a sympathy for each of the other components. But will the profession accept him? This is still the question which is being asked most challengingly by Mr. Will and other leaders in the profession. Is architecture prepared to admit the young man whose degree might now be Bachelor of Architecture in Mechanical Design to the profes sion as an architect?

Acceptance must move in several directions. Acceptance denotes recognition within the profession and within each member organization. The boards of accreditation and the professional societies must be willing to embrace these men with the same handclasp they use to greet today's graduate architectural designer. Steps already have been taken in this direction. Conferences have been held in which the leaders of the profession have sat with the nation's leaders in architectural education. Agreement that education and professional acceptance must come hand-in-hand has been reached. Education has indicated its willingness, even its desire, to provide a curriculum which will produce trained men for a profession eagerly seeking to welcome and absorb them. Individually, architects have indicated their desire to accept the mechanical, structural, and electrical designers as equal members of the total building design team.

But within the profession there still must be general acceptance. The architect primarily educated in the mechanical, structural, and electrical disciplines must be afforded equal opportunity to rise in his firm to executive level. He must be provided with the same earning opportunity, the same recognition for the achievement of his component segment of the finished structure, as the architectural designer. The opportunities are present. In individual architectural organizations this breakthrough already has begun, and in some enlightened few, is far advanced. What seemed remote at a Conference on Higher Education for the Building Industry, conducted at Cornell University, at Ithaca, New York, in late June 1957, now seems just around the corner.

And just around the corner is a new concept of the complete architect, one as dramatic as each new concept of the profession itself.





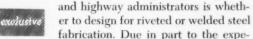
Pittsburgh's new Glenwood Bridge is being designed for either welded or riveted construction, or a combination of both.

### Highway Bridges . . .

### Welded or Riveted?

NORMAN G. MARKS Richardson, Gordon and Associates

A COMMON QUESTION among bridge engineers



rience of designers, availability of inspection personnel, or local fabrication experience and facilities, little or no use is made of welded design in some areas. However, in other areas, experience gained over the last 10 years has prompted almost exclusive use of welding for steel girder bridge spans. Availability of weldable alloy steels has done much to promote the use of welding, and on the west coast, several large truss spans have been designed recently for welded construction with marked success.

Almost all welding skeptics have been convinced by now that shop fabrication by welding can be safe and dependable. The remaining question is one of economics. Highway administrators may well ask, "What is the comparative difference in construction cost between riveted and welded design for my section of the country?"

The only means of firmly establishing an accurate cost comparison is by preparing complete plans for both designs and taking alternate bids. In this way, valuable comparative cost information can be de-

veloped that will be useful on future projects. The new Glenwood Bridge provided an ideal project for this type of analysis.

This project is located in Pittsburgh, Pennsylvania, in the heart of the country's major steel production and fabrication area, and is certain to gain much attention from both producers and fabricators. The bridge includes both girder and truss spans with the usual complications expected on the average job. This will be the first major truss span designed for welded construction in this part of the country, and certainly the first project of this size prepared for alternate designs and bids.

Originally, the plans were being prepared for the Allegheny County Department of Public Works. Later, for purposes of consolidating highway planning for the area, the project became a joint effort of Allegheny County, the Pennsylvania Department of Highways, and the Bureau of Public Roads. Construction supervision will be provided by the Pennsylvania Department of Highways.

Construction of the main river piers was scheduled for completion in May of 1961. Plans for the remaining substructure as well as the alternate plans for the superstructure have been completed and are

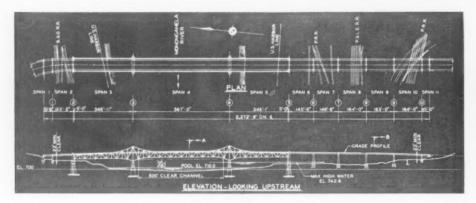


Fig. 1 — Plan and elevation of Glenwood Bridge over the Monongahela. Total length is governed by the many railroad tracks on both banks. The three span, continuous, Warren type truss over the river totals 1260-ft. in length.

scheduled for an early letting date. Plans for the superstructure have been prepared so that it will be possible to award the contract on the basis of any one of four combinations:

¶ All riveted construction.

¶ All welded construction.

 $\P$  Riveted construction for girders and welded construction for girders,

¶ Riveted construction for girders and welded construction for trusses.

#### The Structure

The new Glenwood Bridge will replace an antiquated timber decked structure that was built in 1895. It will span the Monongahela River six miles upstream from the Point in Pittsburgh. As shown in Fig. 1, the total length of structure, governed by the many railroad tracks on either bank, is 2273 feet. The concrete deck will carry two, 26-ft roadways separated by a 4-ft mountable divisor. An 8-in. traffic barrier, set back 8 inches from the face of the curb, separates the 5-ft sidewalk from the roadway.

The river is crossed with a 3-span, continuous, Warren type truss, with a center span of 567 feet, plus two side spans. Total length is 1260 feet. Consideration of the vertical clearance requirements of the river channel and approach roadway grades prevented the use of a pure deck type structure. However, by locating the trusses outside of the deck, on 75-ft centers, it is possible to keep the top chord elevation below the sidewalk level for almost the entire length. Only in the area over the main river piers, where the greatest structural depth is needed, does the top chord appear above the sidewalk. In this area the top chord is always in tension and therefore requires only a minimum of lateral bracing. For the entire length of the structure, the only overhead members are attractive single portal type braces at each of the two main piers.

Approach spans at either end of the main river crossing are arranged for proper railroad clearances. Span lengths vary from 45 to 164 feet, for a total length of 1013 feet. Spans 6 and 7 form a two-span continuous unit, while spans 8, 9, and 10 make up a

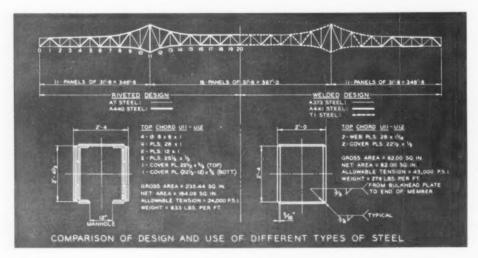


Fig. 2 — Comparison between riveted and welded design. Note indication of the uses of different types of steel in the various structural members. With several choices of steel, members were designed for greatest economy.

three-span continuous unit. Because of tight vertical controls at each end of the structure, minimum depth is achieved with plate girder stringer construction.

#### The Design

In order to insure truly comparative bids between riveted and welded construction, it was necessary that both be made on the same basic structure. The same approach was followed for both designs, allowing variation in detail only to utilize the inherent advantages of welding or riveting.

The design and plans for the riveted structure were prepared on the assumption that members would be shop fabricated using structural carbon rivets and that field connections would be made with either rivets or high strength bolts, with the substitution being made on a basis of one-for-one for like diameters. The design and plans for the welded structure specified that shop fabrication be made by welding and that all connections at truss joints and all field connections be made by either structural carbon rivets or high strength bolts, with the substitution again on a one-for-one basis.

The approach girder spans present no unusual or novel design or construction features. For the riveted design, A7 and A440 steels were used to the best possible advantage. For the welded design, A7 (for details not involving welding), A373, and A441 steels were used to the best advantage.

For the approach and main spans for both riveted and welded designs, extensive use was made of the electronic computer. In the case of the main truss spans, the computer was used to determine the geometrics of the structure and properties of numerous possible truss members, as well as performing trial and final stress analyses.

The design of the riveted truss is conventional, with the chord members made up of webs, angles, and cover plates to form a box section. As shown at the left of Fig. 2, the depth of all chord members measures 2'-4½" b.b. of angles, with the width held constant at 2'-4". Bottom cover plates are perforated with manholes, for ease in driving stitch rivets and for access to the interior for painting. All diagonals are also box sections, built from angles and plates or channels and plates. Some verticals, however, are I-sections formed by angles and plates.

The selection of steel to be used for the members was made from A7 or A440 steel on the basis of the stress in the member and limiting material thickness, with economy as the prime consideration. The actual choice of steel is shown graphically in the left half of Fig. 2.

For the welded alternate, all main truss members, chords, diagonals, and verticals are designed as box sections, with four plates in each member joined at the corners with continuous fillet welds. The width of all members is held at 2'-0". The depth of all chord webs is held at 2'-4", while the depth of diagonals and verticals varies from 2'-4" to 1'-3". The only exception to this is to be found in the vertical member U11-L11, which has an additional center web and measures 3'-0" by 2'-0".

Since these members are made by joining plates by welding and do not require the use of rolled shapes, it was possible to use a heat-treated, high strength, constructional alloy steel (T1). The basic unit stress for T1 steel in tension was set at 45,000 psi for all thicknesses. To make up a member, a selection was made from three types of steel — A373, A441, and T1—with an available range of basic unit stress in tension varying from 18,000 to 45,000 psi.

With three steels from which to choose, the proper selection was not always readily apparent. Thus, the member was designed for two and sometimes all three steels, a total weight was established for each type of steel, and a final choice was made on the basis of comparative costs.

A structure designed to take full advantage of T1 steel will require less steel than one designed with steels of lower allowable stresses. Also, main members fabricated by welding plates together will make more efficient use of steel. In the case of top chord member U11-U12, these weight savings will combine to show a very marked reduction in total weight. As shown in Fig. 2, the riveted member designed with A440 steel weighs 833 lbs per ft, while the welded member using T1 steel weighs 279 lbs per ft. Not all members show the difference between riveted and welded design as distinctly as does this highly stressed tension member.

Comparative savings in weight for the welded design are not limited to main members. Details are also simplified and reduced in size. This is emphasized by a study of joint U11, as shown in Fig. 3. The weight of the connecting material at this joint for the

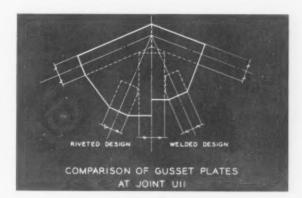


Fig. 3 – Comparison of weights of this joint for riveted and welded designs showed a 6 ton saving for the latter.

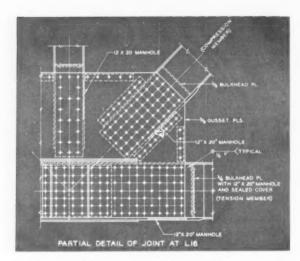


Fig. 4 – Hand holes and manholes provide access to the unsealed areas at the ends of welded sealed box members.

riveted design is 21,400 lbs, while the connecting material for the welded design is 8600 lbs. This reduction in size and weight can be attributed primarily to: The approximately 11 percent reduction in total stress in truss members, due to lighter truss weight. More efficient spacing of high strength bolts, because staggering is not required to maintain proper pitch in angles, or net section.

¶ The reduction in the number and thickness of splice plates, so that extra bolts are not required for indirect splices and excessive grip.

#### Sealed Box Member

The most interesting feature of the welded design is the use of the sealed box member. Members closed by welding to prevent corrosion and to utilize maximum efficiency of a structural section have been used in other construction fields for many years. However, this may have been the first time sealed members were considered for a main truss span.

The sealed section is a natural development of welded fabrication. The main truss members and the majority of the lateral bracing members are box sections made by joining four plates at the corners with continuous fillet welds. These sections are sealed air tight at the ends, clear of the field connections, with bulkhead plates. Access to the unsealed areas at the ends of the members is through open manholes in the bottom cover plates or through hand holes in the bottom cover or web plates, as shown in the detail of the joint at L16, Fig. 4.

Maximum efficiency of section is attained with the elimination of manholes and hand holes in the sealed section between end bulkhead plates. In these sections the respective gross, net, and distortion areas are identical, and an average weight reduction of 4 to 5 percent is realized when sealed sections, rather than conventional sections with perforated covers, are used. Fabrication costs are reduced with the elimination of the cost of burning out a great number of manholes. To these savings can be added the reduction in cost of subsequent maintenance resulting from an estimated reduction of 22 percent in total painted area and the elimination of difficult interior painting.

Based on experience in other construction fields, it is apparent that normal welding techniques will assure an air tight weld. After thorough investigation, it originally was proposed that the box members be sealed air tight by welding and that the interior should not be painted or provided with access openings. However, caution prevailed, and final plans will provide for an inspection access hole, covered and sealed, at one end of each member. Plans also will require one shop coat of rust-proofing compound on interior surfaces, probably applied by the flow coat method. Air tightness will be assured by applying a 5-psi air test to the sealed member.

#### Comparison of Weights and Costs

A comparison of the estimated structural steel for the two designs indicates that the total tonnage required for the riveted design is 7540, while the total tonnage required for the welded design is 6180. As shown in Table 1, the welded design allows a reduction of 880 tons of truss span steel and 480 tons of girder span steel — a total reduction of 1360 tons.

The reduction in steel required for the girder spans can be attributed directly to the efficiency of welded construction. The same range of allowable stresses in steels was used for both designs, and no unusual innovations were suggested for either design. This is

	TABLE	1	
ESTIMATED ST	RUCTURAL ST	EEL WEIGHTS IN	N TONS
Type of Steel	Truss Spans	Girder Spans	Tota!
	Riveted De	esign	
A7	3125	804	3929
A440	2088	1377	3465
Miscellaneous	135	11	146
	5348	2192	7540
	3340	2112	75.0
	Welded D	esign	
A7 and A373	3000	539	3539
A441	529	1163	1692
TI	818	_	818
Miscellaneous	121	10	131
	4468	1712	6180
Difference	880	480	1360

TABLE 2—COMPARISON OF STRUCTURAL STEEL IN VARIOUS COMPONENTS OF MAIN TRUSS SPANS
Weight of Steel in Tons

	Riveted Design	Welded Design	Reduction	% Reduction
Main members	2106	1646	-460	21.8
Joints	518	301	-217	41.8
Stringers, diaphragms, pads, and bracing in deck	807	796	~ 11	_
Floor beams	957	781	-176	18.4
B.C. laterals struts, sway frames, and portals	665	673	+ 8	_
Inspection walkways, exp. dams, drainage, and shoes	295	271	- 24	8.1
Total	5348	4468	-880	16.5

not true of the truss spans. In addition to the obvious inherent advantages of welded construction, it was also possible to take advantage of the high strength T1 steel for the more highly stressed members and to use to advantage the sealed box section.

In Table 2 a comparison is made of the steel required for the various components of the truss span for the two designs. It is interesting to note that about 22 percent less steel is required for the welded main members than for the same members made by riveting; 42 percent less steel is needed for the connecting material; and 18 percent less steel is used for the welded floor beams. Only the floor system, bottom chord laterals, and other secondary members show no particular advantage to either design.

It is interesting to compare the two alternate designs, to see how, where, and how much weight saving is possible. However, the big question still remains — how much, if any, actual savings in dollars and cents can be realized with the welded design. The final answer to this will have to wait until bids have been opened. But, armed with knowledge of the alternate designs, data on previous bids, and some common sense, it is possible to formulate a rational cost comparison.

In Pennsylvania, fabricated structural steel is bid and paid for on a unit price per pound basis. This price includes base cost of steel, fabrication costs, erection costs, painting, overhead, and profit. Recent bidding for this work has been highly competitive, resulting in some very low unit price bids.

Past experience would indicate that the unit price for all of the steel in the riveted truss spans would be in the range of 25 to 30 cents per pound and for the riveted girder spans in the range of 21 to 25 cents per pound. Using this range of prices, it is possible to conclude that for the same total bid the corresponding range of unit prices for the welded alternate would be 30 to 36 cents per pound for the truss steel and 27 to 32 cents per pound for the girder steel. This represents a difference in the per pound price of welded steel over riveted of 5 to 6 cents for the

truss spans and 6 to 7 cents for the girder spans. Obviously, if the welded design is to show economy this difference will have to be reduced.

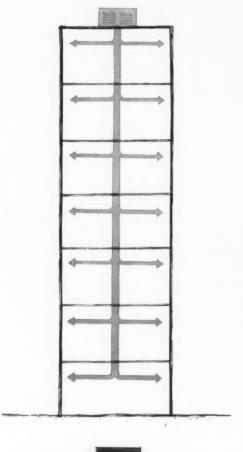
An analysis of a hypothetical unit price bid for the welded spans, in comparison to riveted prices, would indicate some plus and some minus entries. The base price of steel, for instance, would certainly increase. This increase would reflect the higher cost of the weldable steels. For the truss spans, it would also include the higher priced T1 steel.

The total erection cost of the structure should be about the same for both designs. The lighter welded structure would, therefore, be priced more per pound. The cost of field painting, on the other hand, should be less for the welded structure, considering the smooth surfaces and sealed box members. The net effect due to erecting and painting costs would, in all probability, result in some increase in the unit bid price for the welded design.

Fabrication, overhead, and profit are costs that for the most part depend on the management, experience, and facilities of the individual fabrication shops. Values assigned to these items by each shop could vary considerably and undoubtedly will influence the final outcome of bids.

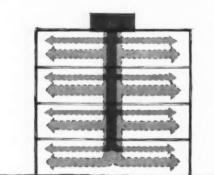
Considering all of the variables that influence the unit bid price of fabricated structural steel, predictions are at best risky, and subject to hindsight criticism. Nevertheless, it is predicted that the unit price for the welded design will be no more than 2 cents a pound greater than the bid for the alternate riveted design. With only a 2 cent spread in the unit price, the possible savings would be in the range of 3 to 4 cents per pound for the truss spans and 4 to 5 cents per pound for the girder spans.

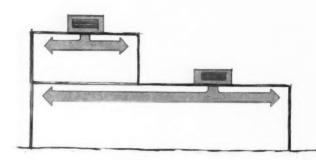
On this basis it is estimated that the welded design could show a saving ranging from \$405,000 to \$528,000. Whether this will be borne out by the final tabulation of bids remains to be seen. In any event, this is one project that will not be followed by vague claims of economy by proponents of either riveted or welded methods of fabrication.



# Systems Selection For Air Conditioning

SIDNEY A. LITTMANN Giffels & Rossetti, Inc.





Taller buildings usually require high-velocity distribution systems, while low velocity systems are advised for 1 or 2 stories. Either system may work for 3 or 4 story buildings.

DESIGNING an air conditioning system would be

easy, if all clients were alike; all buildings were alike; all buildings were subject to identical building and

refrigeration codes; and all buildings, occupancies, and climatic conditions were similar. But since all of these vary, the consulting engineer must determine the individual requirements on each project and select the air conditioning system accordingly.

#### Factors in Systems Selection

The greatest influence in selecting air conditioning and air distribution systems is the basic size and shape of the building. Budget limitations on construction, the occupancy, and lighting levels — usually established by the owner — are other strong factors.

Whether the building is owner or tenant occupied also influences air conditioning design. Tenants expect, and usually get, more complete individual room control. At the owner's risk, the owner occupied building can be designed for minimum occupant comfort, but it is the engineer's duty to explain that employee grievances may be encountered when extreme outside weather conditions occur.

The use of large areas of glass curtain wall presents problems. Cold convection currents from the glass



Double-duct low velocity system serves Cross Company Office Building. Offices are zoned according to exposure and use.

must be prevented from sweeping the floor areas and causing occupant discomfort. Normally, this is not a serious problem with high velocity systems.

#### Systems for Multistory Buildings

High rise or multistory buildings permit the engineer a wide latitude of system choice. Conventionally, high velocity air distribution systems are favored in such buildings, since the larger ducts required for low velocity systems take up too much of the valuable building volume.

The high velocity double duct and multizone systems, high velocity perimeter induction systems, or individual room fan coil units provide suitable individual room control for tenant occupied multistory buildings. They also are effective in offsetting cold convection currents generated by cold exterior glass walls. However, these systems have limitations that must be considered. For example, none of them can be modified easily to handle greater heating or cooling loads than provided for in the original design.

When making a selection for a multistory building, the following characteristics of various systems must be considered:

¶ Conventional perimeter induction systems inherently have a summer to winter changeover point at

which water temperatures in the induction units must be changed from cold to hot, and where operation of controls for water flow is reversed. Unless internal loads for all spaces that have water piping zoned together are reasonably equivalent, some tenant discomfort will be encountered whenever room temperatures go out of control at or near the temperature reversal point.

Fan coil systems, when installed conventionally, have similar limitations during changeover. Due to the proportionally larger number of fans and filters used in this system, higher maintenance costs can be expected. Fan coil systems also can produce excessive or undesirable noise — or both — unless special selection of units is made. When used with outside air intakes, acoustic treatment generally is required to exclude street noise.

¶ High velocity double duct and multizone systems usurp more building space than either perimeter induction or fan coil systems. Also, operating costs are often substantially greater, because of the continuous high fan horsepower requirements. Since these systems employ no liquid heating medium along the perimeter, the air conditioning fans must supply air for winter heating. A substantial warm-up period must be allowed before the building is occupied,



Separate zoning treatment was required in the cafeteria of the International Business Machine Company plant, in Owego, N. Y.

which may require continuous running of the system. It is possible to build these systems with provision for a perimeter radiation system, which would somewhat reduce the heating operating expense. However, the first cost of such a combined system may indicate that some other means of conditioning the building will prove more economical and equally satisfactory to the client.

Self-contained air conditioning units often permit a reduction in piping and insulation costs, and allow the building management to make air conditioning optional for each tenant. Meters, if provided for in the building's electrical design, permit individual tenant billing for power use. As with fan-coil units, operational noise is a possible objection, and is often aggravated by the presence of integral refrigeration equipment. Some fairly large air conditioning installations have been made successfully with units mounted in the exterior walls.

Single duct supply from a central system should be given consideration where areas in multistory buildings have no exterior exposure and share similar occupancy. This system will be required to provide cooling throughout the year, due to internal heat gains from lights and people. Thus, it conceivably could provide the source of heat for a heat recovery system. In conjunction with this system, individual fan-coil units on each floor, which would require only nominal make-up air from the outside, might be considered. Although this greatly reduces the area of vertical ductwork, it costs more to operate, since year-round refrigeration is required. Given a sufficiently large interior room space with sufficient

heat gain, this type of system, used in conjunction with a heat pump, might prove the most economical.

#### Systems for One and Two Story Buildings

While roughly the same parameters of budget, occupancy, and lighting apply to low buildings, they may not be of the same design magnitude as highrise buildings. For example, a small office area may require only a single zone. However, it is also possible that for an equivalent total area, there will be private offices requiring individual control.

Also, there are certain types of rooms that never should be zoned with any others. Specifically: lob-



Single zone fan systems are used in each of four equipment rooms at the Royal McBee typewriter plant, Springfield, Mo.

bies and vestibules; computer rooms; conference rooms; cafeterias; laboratories; and other spaces that have widely varying internal heat gains, occupancies, or peak load timing dissimilar to adjacent areas.

When dealing with one and two story buildings, it is not generally economically feasible to use high velocity air handling systems. The added building construction required to accommodate larger low velocity ductwork normally does not cost as much as the increase in building cost for heavier, acoustically treated high velocity ducts, larger fan rooms, more expensive electrical systems, and the cost of additional refrigeration needed to overcome higher fan input. Operational costs are also higher.

For one and two story buildings where individual temperature control for various spaces is required, one, or several, of the following should be considered: individual fan coil units with central water chiller; individual self-contained air conditioning units; central multizone system; central dual-duct system; central air cooling system with zone re-heat; and central air heating system with zone cooling. The characteristics of these systems are:

Individual fan-coil units with central water chiller usually satisfy individual room control requirements. Provided no additional make-up ventilation system is required, these units cost less initially than other systems of equal flexibility. For conditioning buildings where all rooms are exterior facing, the units can be installed at exterior walls through which fresh air ducts are built. Several manufacturers have developed specific equipment for this use. It is not appropriate where the outside wall is all glass or where the sill line is too low for mounting the cabinet. When architectural design allows this system to be used, careful consideration must be given to maximum acceptable noise generation levels both

from the machine itself and from outside the building, and also to lack of control during the seasonal changeover periods.

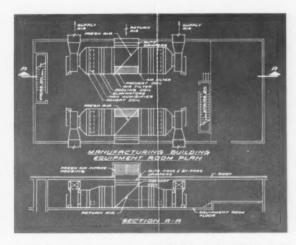
Individual self-contained conditioners can be justified only under special circumstances. Where old buildings, not originally air conditioned, have had under or in-window units installed, it is usually because there was no available space for the equipment, or the installation could be made with minimum disruption to occupancy. Individual units may be objectionable since the compressor must be in the room it serves, thus increasing noise level. Units located remotely from the spaces they serve can offer an economical approach to this problem, as sound attenuation may be achieved in the ductwork. Also, if the unit is air cooled, horsepower per ton of refrigeration becomes excessive, which increases operating costs. If water cooled units are employed, water and power supply lines to the equipment interfere with the occupancy of the space, and the benefits of this particular system largely disappear.

Codes that require the presence of a licensed refrigeration operator for equipment above a relatively small size, say 25 hp, can provide a powerful incentive for the design of systems of individual selfcontained units. However, when making a design decision on this basis, the engineer should be careful to ascertain that the code limitation refers to the individual refrigeration circuit, and not to the aggregate rating of all the units in the building.

These units require a reasonable amount of space for service, and the multiplicity of units may result in inefficient service and maintenance. As these units normally are controlled by cycling of the compressor from room temperature, somewhat sloppy control may be expected. Multizone self-contained units are not yet generally available, but this type of unit would



Practical limits of fan and coil size determine selection of zones in large areas such as this IBM assembly plant.



Typical equipment room in IBM plant. The total fan capacity is 380,000 cfm for this 180,000 square foot building.

be quite suitable for providing air conditioning for small office buildings and doctors' clinics. Compressor control would necessarily have to be from refrigerant suction pressure, and methods such as hot gas bypass for preventing compressor short-cycling would have to be included in the unit design.

The central multizone system, using built-up fancoil rigs, is well suited to reasonably compact buildings, where the number of zones is not too great. If a substantial number of zones are located at a great distance from the equipment, the ductwork cost becomes excessive. However, for the usual one or two story building, the central multizone unit would be my preference. In long narrow buildings, typified by office space for large manufacturing plants, it is often advisable to use two such units, located at the quarter points of the building's long axis.

The double duct system, using built-up fan and coil rig, has its principal application where a large number of zones are necessary, or where extreme flexibility of partition arrangement is a criterion. The difficulties inherent in this type of system are generally well known, and are avoided by careful attention to mixing damper leakage control, and to static pressure regulation in the hot and cold main ducts. As with the multizone rigs, two systems may prove to be desirable for long narrow buildings.

Central cooling systems with zone reheat normally are suited only to special applications, particularly laboratory buildings. There is a substantial saving in the cost of installation of ductwork with this system, but the added cost of piping and heating coils, depending on the application, cancel the savings in ductwork. Operating costs are high because it is necessary to cool all the air handled by the fan to the temperature and humidity required by the space which requires these to be the lowest. Portions of this air then must be reheated to achieve room control. The primary cooling coil and refrigeration unit must be sized for the sum of the peak loads of all zones, since there is no diminution of coil load with room loads. Control of room conditions is excellent with this type of system, as it possesses flexibility and pressure control when required.

Tentral heating with zone cooling entails excessive piping costs due to local drainage requirements at cooling coils, and operating cost is excessive because of the greater prevailing cooling requirements. An induction system with primary air heated or cooled by a central fan system becomes a central heating system with zone cooling at certain stages of the changeover cycle. However, in this instance, if the system is designed properly, the local drainage is not required. Also, there is no penalty on refrigeration requirements because the cooling is performed on the room air. Adding on terminal cooling coils to an existing heating system would appear to be far

less practical than converting the fan rig to cooling, and adding terminal reheat, if necessary, to achieve room temperature control.

In most buildings of varied occupancy or of considerable size, no one type of air distribution will prove to be ideal for all the spaces to be served. Several different types of systems, or combinations of systems may be required, depending on the particular project. For example, three or four story buildings do not necessarily conform to the general observations about either multistory or one and two story structures. These buildings constitute a gray area, which requires special study.

It also should be pointed out that this discussion is oriented toward comfort air conditioning, rather than process cooling, although some of the same considerations would apply to both.

#### Refrigeration Equipment

Another important aspect in the design of air conditioning systems is selection of refrigeration equipment.

For the smaller single zone systems, when cycling of the refrigeration equipment is an acceptable temperature control method, self-contained air conditioners — fan, coil, and condensing unit in a common cabinet — are preferred. The practical capacity limitation for this type of equipment is in the neighborhood of 20 to 25 tons. The simplest form is the window mounted room cooler, available from ½ to 2 tons. These are complete cooling systems with air cooled condensers. Their principal use is in residences, motels, and isolated small spaces such as a gatehouse or a single small office in the midst of



Low partitions, as in this IBM office area, can be neglected when determining zone limits for air conditioning.

a factory. Their first cost is low, but their efficiency is also low. Their life is relatively short, and above the 1-ton size, they are noisy. They sometimes are used in old buildings, where other forms of air conditioning would be especially expensive because of structural or space limitations. This practice is not recommended in new commercial or industrial construction. A similar unit is available with frames for mounting in the wall or in console cabinet; this type is available with a heating coil for year-round use.

In the range from 1½ to 5 tons, a large variety of low cost packaged equipment is available, designed primarily for residence air conditioning but sometimes practical for small commercial and industrial installations. These usually are installed with ductwork and may be obtained in horizontal or vertical models, with water, air, or evaporative condensers. Heating may be omitted or may take the form of steam or hot water coils, gas duct heaters, or residential type gas or oil fired warm air furnaces. When direct fired, these units are limited to two position control on both heating and cooling and are not suitable for the introduction of more than 10 percent outside air where temperatures below freezing can be expected. They are best suited for locations where population density is light, where there are no exhausts, and where infiltration is sufficient for ventilation.

Self-contained cabinet type units with water cooled condensers are available in sizes from 3 to 25 tons. In sizes up to 7½ tons they may be installed with ductwork, or exposed in the conditioned area. They are not suitable for use with more than 25 percent outside air, or where low noise level is an important consideration. If an outside air connection is used, an automatic damper must be provided to close it when the fan is not running to protect the condenser against freezing. Air filters are available from most manufacturers on special order and should be specified on most projects.

There is no flexibility in the design of these units, and they never should be overloaded at design conditions, or underloaded more than 15 percent in applications where air changes are high. Because of this lack of flexibility, multiple installations in office type space frequently run into problems, hence other types of systems usually are preferred. They are useful in isolated spaces of medium size, especially when condenser cooling water is cheap and can be wasted. Except where population densities are high, as in a conference room, these units should be selected on the basis of sensible rather than total capacity, taking into account that room relative humidities will be well below 50 percent.

For close-coupled systems, where the coils are within 100 feet (developed length of piping) of the compressor, direct expansion systems are preferred. Code limitations may preclude the use of direct

expansion for air conditioning coils serving institutional occupancy areas such as jails and hospital wards. Control is achieved by splitting the coil into several circuits, each with a solenoid valve upstream of the thermal expansion valve, under sequence control of the room or duct thermostat. Capacity reduction should be specified so that the load, with one coil section in operation with the lowest anticipated entering air temperature, shall exceed the compressor capacity at the lowest step of its capacity modulation, to prevent short cycling.

Alternatively, where the load is smaller than 15 tons, capacity control of the compressor is not generally available, and the compressor may be cycled by the room thermostat. In such situations, a single cycle pump-out invariably is required, and is preferred under all circumstances.

Equipment sizes are limited to about 125 tons in a single frame, but no serious difficulties will result from use of this type of equipment in battery, provided that refrigerant circuits are not interconnected. Where multiple compressors are to be used, each compressor must be balanced out with its condenser or condenser circuit, and with its evaporator coil or coil circuit just as though it were a separate system. Before proceeding with the design of multiple systems using packaged air conditioning units, it is important to make sure that the desired circuiting of the coils will be available.

In sizes over 200 tons, a centrifugal water chilling system normally will be less expensive than a direct expansion system using multiple reciprocating compressors. The opposite is true below 100 tons. From



Multizone units serve north, south, east, west, interior zones in Giffels & Rossetti engineering offices, Detroit.

100 to 200 tons, the direct expansion system will be less expensive only when the system is close-coupled and there are not more than three evaporator coil banks. Where noise and vibration are items of serious consideration, the centrifugal system is preferable to reciprocating systems, and the hermetically sealed centrifugal unit is preferable to the open machine with or without gear drive.

Code restrictions may require licensed operators for direct expansion equipment of 25 tons or greater

capacity in a single machine.

Centrifugal water chillers are preferred for the larger installations. The water distribution system is not limited by the distance from machine to coil as it is for direct expansion systems. Response is quite rapid, both at start-up and to changes in load. Modulation of capacity down to about 15 percent of full load is quite stable, below 15 and down to 10 it is less stable, and below 10 the machine will cycle on low temperature cutout but normally will not short cycle because of the high heat storage capacity of the water system.

Codes require licensed operators for this equipment in many localities, but this is not universal.

Chilled water temperatures lower than about 38 F should not be selected for this equipment because of the risk of freezing the chiller. Extreme care should be used in arranging the ventilation system exterior air supply and preheaters in order to avoid stratification which might result in freezing of the chilled water coil.

Absorption water chillers do not require licensed operators under most codes, and therefore are recommended in locations where codes would require operators for other types of equipment and where the elimination of operators is an overriding consideration. Such equipment costs more initially, requires greater water quantities and larger cooling towers, and part load operation is less efficient than for the centrifugal or reciprocating equipment. Response on start-up is extremely sluggish, although capacity control is somewhat better at low capacity ranges. Because of the corrosive nature of the solution used in absorption equipment, maintenance costs of such equipment are relatively high. Chilled water temperatures of lower than 44 F require substantially increased heat inputs.

Aside from consideration of the cost of attendance by licensed engineers, these machines may be selected for reasons of operating economy where power costs exceed 1 cent per kwh and low pressure steam is available in summer for less than 50 cents per 1000 lbs. This may occur in industrial plants where large boilers must be operated in summer to take care of small process loads, or where waste steam is available, as sometimes occurs in refineries, chemical plants, and with private power stations. Above

300 tons, when low cost steam is available at 50 psig or higher, a steam turbine driven centrifugal compressor system usually will be preferred to an absorption system.

Absorption machines usually are provided with condensing water from cooling towers. Where it is desired to use well water or river water at temperatures below 80 F, it is necessary to use recirculating pumps and expensive mixing valve controls, which make the absorption system much less attractive in comparison with other types of equipment.

Steam jet water chillers use considerably greater steam flows than absorption equipment of comparable capacity, and when furnished with barometric condensers are substantially taller. These should be selected only where the cost of steam is nominal, and where adequate vertical space is available for their installation. The vertical height limitation may be disregarded if surface condensers are used. They require relatively large quantities of steam for refrigeration and small quantities of high pressure steam to work the purge system.

#### **Unique Conditions**

It should be apparent that circumstances peculiar to specific projects can easily upset all preconceptions. For example, our firm has selected one type of air conditioning equipment because it was the only type which was manufactured by that client. We have used steam jet refrigeration equipment because the client needed to have a way to dispose of some substantial quantities of steam at elevated pressures. We have used absorption equipment for our offices, not because it was less costly, but because Detroit codes require a licensed operator for fluorinated hydrocarbon equipment at the capacity involved.

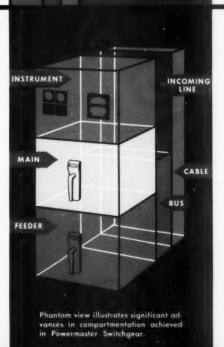
There are practical limits to the extent to which the need for licensed operators should be the criterion for deciding which type of system should be used. In many instances, if the refrigeration equipment is located in the boiler room, the boiler operators also can handle the refrigeration equipment, making additional personnel unnecessary. Also, where the cost of refrigeration equipment is high, if the installation is extremely complex, or if a high degree of reliability is required, there should be a competent operator in charge, regardless of code limitations, for the owner's protection.

There are no hard and fast rules for any particular air conditioning installation. Rather, the attempt has been made to point out some of the pitfalls that beset the unwary. The ultimate selection of the system will depend upon the economics of the specific installation, with all its ramifications. Ideally, it should be the system least costly to own which fully meets the owner's requirements. That selection is the function of the consulting engineer.

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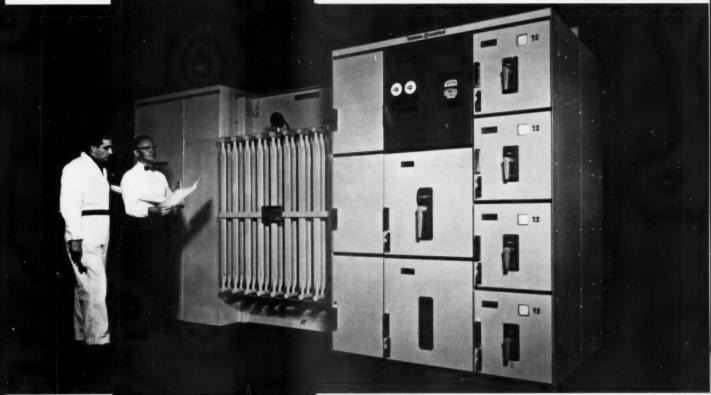
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THE IDEA OF BUILDING a submarine tunnel link-

Cresclusive ing England and France is as old as Napoleon. Nearly 160 years ago a French engineer put up a plan, but

France's ruler was too busy making war to be interested in this first Channel tunnel proposal. However, the idea of a Channel tunnel did not die. Throughout the 19th and early 20th centuries it fired the imagination of scientists, engineers, politicians, writers, and even economists. It provided the subject matter for numerous books, studies, and articles — some giving highly dramatic accounts of the supposed strategic perils to the British Isles.

Perhaps, understandably, earlier examinations of the Channel tunnel project were concerned primarily with technical and political problems. They either ignored its financial aspects or took its financial success for granted. The first real attempt to come to grips with the economics of a Channel tunnel was made by a British Parliamentary Committee appointed in 1929 by Prime Minister Baldwin. It remained the only comprehensive economic investigation until the Channel Tunnel Study Group report of 1960.

The Parliamentary Committee had collected evidence and opinion from a wide range of firms and organizations in industry, commerce, and transport. It then proceeded to assess the traffic potential of

then being carried by railway Channel shipping on the short sea routes. If these traffic estimates were hardly calculated to attract the private investor, the pronouncement by the Committee that costs of transport would be "no higher" than the ruling rates was equally unappealing to the user.

By comparison, the report published by the Channel Tunnel Study Group in 1960 makes cheerful reading. Throughout the report runs the theme that a Channel tunnel is a practical proposition, both technically and financially. Technically, the Study Group declared, the best means of linking England and France would be - to start with at least - a railway tunnel consisting of two separate one-way tubes either immersed or bored - with facilities for speedy and convenient transport of cars, coaches, and lorries in specially designed trains. After examining the merits of both the immersed and the bored tube, the Study Group reported in favor of the bored version, which was slightly cheaper. It was to have an underwater section at least 20-miles long and some 6 miles of approaches on either side, making a total distance of 32 miles between portals.

Engineering work was estimated at \$224 million, railway installation between terminals at \$28 million, terminal stations at \$39.2 million, and rolling stock at \$16.8 million, for a total investment of \$308 million.

Improvements to French roads serving the terminal would add a nother \$5.6 million, bringing total construction costs to \$313.6 million. In addition, some \$56 million would have to be provided to

meet financial and other charges incurred in the five years it will take to complete the tunnel. However, provision of the funds for railway installations might well be made the responsibility of French and British railways. They have a major stake in the tunnel, and much of the money they might be asked to spend would be spent anyway on cross-Channel services.

The twin-tube railway tunnel proposed would be much the cheapest way to establish a permanent fixed

# Is A Channel Tunnel Feasible?

THE ECONOMIST INTELLIGENCE UNIT LTD.

the tunnel. Its findings were not particularly encouraging. Although the tunnel would cost only about \$84 million to build, the traffic it was expected to attract would not assure its operators of a financial return appreciably in excess of 4 percent. In 1958, the year assumed for opening the tunnel, it would carry an estimated 2.4 million passengers out of a total cross-Channel traffic forecast of around 3.5 million. Goods traffic would be little more than the 120,000 tons

link between England and France. A road tunnel, naturally, was considered, but it did not gain the approval of the Study Group. First, there is the difficult, if not insurmountable problem of ventilating it. Second, there is the problem of guarding against fire and vehicle breakdown. Third, a road tunnel is not as economically feasible as a railway tunnel. Although the distance between terminal stations would be shortened to only 26 miles, of which 23 miles would be below the sea, the total estimated cost ranges from \$361.2 million for a 36-ft diameter to \$428.4 million for a 39%-ft diameter. Finance and other charges to be met while the tunnel is being built would add another \$70 million.

Thus, total construction costs of a road tunnel would exceed those for a railway tunnel by 17 or 35 percent respectively, whereas the traffic carrying capacity — and hence the revenue earning power — of the larger road tunnel has been estimated to be something like a third less. Admittedly, a combined railway and road tunnel would impose no similar limitation on capacity, while catering to all demands. But its cost, almost certain to be well in excess of \$560 million, puts it outside the realm of what could be considered economically feasible.

Similar objections must be leveled against the much canvassed project of a Channel bridge. The idea itself is very attractive. A bridge would provide almost unlimited capacity for both road and railway traffic. It would eliminate the ventilation problem and appreciably reduce maintenance. Costs are, however, another matter. Various interested groups have come forward with different estimates, but according to the Channel Tunnel Study Group's assessment, bridge construction alone would cost some \$504 million.

The capacity of the twin-tube rail tunnel envisaged by the Study Group would be far greater than any traffic that it could reasonably be expected to attract in this century. Experts have estimated that peak capacity would be 12 trains per hour in each direction, with total potential operation over a 16-hour day of 125 trains in each direction. Each train is capable of carrying 700 passengers, or 300 accompanied cars, or 600 tons of goods.

What does this mean in terms of traffic handled? To simplify matters, it is assumed that goods would not, indeed must not, be carried in peak periods, although they would form quite a large proportion of the tunnel traffic. Hence the tunnel would allow the passage of either 8400 passengers or 3600 accompanied vehicles per hour and per direction. If this traffic were divided equally — with six passenger and six vehicle trains — peak hour capacity in each direction would be 4200 passengers and 1800 accompanied vehicles. This compares with projected 1980 requirements in the 30th highest hour of approximately 2000 passengers and less than 800 vehicles. Clearly, the

sponsors of the tunnel scheme are taking no short views. They are planning for the traffic needs of two and perhaps three generations to come.

On the basis of its traffic projections, the Channel Tunnel Study Group estimates gross receipts at \$36.4 million for 1965 - the assumed first year of operation - and at \$58.8 million for 1980. Of the 1980 receipts, which represent over 15 percent on the estimated capital invested, interest and maintenance charges probably will take more than 40 percent. (The Study Group envisages raising four-fifths of the capital in the form of bonds, and, if these are not guaranteed by the British Government, they will need to bear a high rate of interest to appeal to the investor.) Part of the 60 percent - or less - left to the tunnel operating agency would go to the French and British railways as payment for the trains, carriages, wagons, power, and services provided by them. Precisely how big a slice of the receipts the railways would get is not known, but it is evident that the tunnel would pay its way with something, but not very much, to spare.

The traffic projections from which the receipts are computed may well turn out to err appreciably on the low side. With commendable caution, the Study Group has, at most stages of its investigation, selected the least favorable of a range of possibilities.

Reasonably enough, the Study Group expects that most of the accompanied vehicles going to and from England would use the tunnel and that this new facility will generate traffic which, without it, would never exist. But the projections include only a modest generation element, and the assumptions about European car ownership upon which they ultimately rest are more modest still. The passenger traffic projections allow for no generation whatever, for a very moderate attraction of short-range air traffic, and for little more than 65 percent diversion of the available sea traffic. The remaining 35 percent of passenger traffic is assumed to prefer cross-Channel sea routes.

The data from which tunnel goods traffic is projected exclude all bulk goods, which make up fully two-thirds of Anglo-European trade. Of the remainder — general merchandise — little more than one third is deemed to be divertible to a Channel tunnel. The goods traffic projections also entirely ignore the heavy increase in trade that would result if Britain were, in the end, to join the European Common Market. Thus, no one can accuse the Channel Tunnel Study Group of being overly optimistic in its forecasts.

Yet despite the conservative traffic assessments, the tunnel would offer cheaper service than existing cross-Channel facilities. Suggested average tolls of \$4.50 for passenger, \$16.25 for a car with driver, and \$5.90 for a ton of goods would be 5, 30, and 50 percent, respectively, below average charges presently made on Channel ferry services — and the operating agency would earn a useful profit. There can be

little doubt that it could offer some lower charges than those now being contemplated if tunnel traffic grows faster than the Study Group expects.

#### The Engineer's Problems

The steady improvement in engineering techniques has made it possible to say that a tunnel under the Channel is feasible and that it should be a rail tunnel. All of the serious studies made on this subject during the past 30 years agree on this. They also agree on the best route for a tunnel. This is not to say that such a project would not encounter considerable technical and geological hazards. In an undertaking of this size, it would be odd indeed if there were none of these. The central fact that this would be a long, underwater tunnel gives rise to the main difficulties. While land tunnels of considerable length have been constructed, it has almost always been possible to obtain access to intermediate working faces, breaking up the task into a number of smaller sections and thus speeding up the work.

The most attractive location for a tunnel obviously lies where the Channel is narrowest. On this basis, the best line runs eastward from Dover to Sangatte on the French side — a distance of only 20 miles. The general depth of water at mid-Channel is about 165 feet, although local deep-spots of 279 feet were found during the 1958-59 study. However, the tidal range is about 20 feet, and these Straits, used by the long established cross-Channel ferry service, have a reputation for frequent periods of bad weather, doubtless due to the funnel-like coastlines which concentrate the tides, and the prevailing weather stream coming up Channel from the southwest.

The coastlines on both sides of the Straits are formed by cliff faces – those at Dover being known more for sentimental than for engineering reasons. Studies at various dates, but particularly the more extensive ones of 1875-6 and 1958-9, leave virtually no doubt that the chalk in the cliffs on both coasts is part of the same geological formation. Therefore, this formation may be assumed to extend beneath the Straits as well. This assumption is fundamental to the proposal for an underwater tunnel.

The relevant geology is itself fairly straightforward. The cliffs consist of three layers of chalk — upper, middle, and lower — and at the base of the latter is a layer of glauconitic sandy marl. This rests on a 150-ft thick bed of gault — a stiff, fissured clay, below which are the Folkestone beds of the lower greensand, a water bearing stratum. All these beds dip in a north-easterly direction; the base of the lower chalk, for example, dips at a gradient of about 1 in 61, the strike being 57 degrees west of north. The lower chalk, exposed in the cliffs near Folkestone, thus forms part of the sea bed a few miles to the northeast, off Dover, and this stratum, ranging from 213

to 262 feet in thickness, appears to offer the most attractive route for a tunnel. It shows very little seepage, it is soft enough to be excavated by machine, and yet is of sufficient strength to stand without timbering — in short lengths at least — while the tunnel is being lined. Rock samples from sea bed, as well as evidence from the British and French sides, suggest that the lower chalk is continuous across the Straits. It remains to be seen from a more detached survey, however, whether the sea bed here is free from transverse faults. The 1958-9 investigations did disclose some slight faults parallel to a possible tunnel line.

The sheer size of any Channel tunnel project accentuates the problems normally encountered in tunnel construction — length, ventilation, drainage, and access — quite apart from some remaining doubt about the conditions that actually will be met. These factors strongly suggest that a pilot tunnel should be constructed before any final decision is made.

If a pilot tunnel were to be built on the center line of the twin bores generally proposed for the main tunnel, it not only would provide a final, reliable guide for the construction of the main tunnel, but also could enable it to be built from a number of faces simultaneously, speeding the work as well as providing means for ventilation and removal of spoil. An alternative solution to this last problem - one of vital consequence in so long a tunnel - is to form a slurry of excavated material and to pump this out to the sea bed at bore holes along the line of route. A pilot tunnel, it has been suggested, should be about 12 feet in diameter; it thus could become an early and very welcome source of revenue once it was completed, for it could be used for telephone and electric power cables, and also for oil and natural gas lines.

It seems that a pilot tunnel probably would take several years to complete if work could be carried out on the undersea section only from each end. To overcome this limitation it has been suggested that artificial islands could be created, from which access shafts could be run. The suggestion seems more exciting than practical. The great depth of water, bad weather, and the hazards to and from the heavy maritime traffic in the area would be serious obstacles, to say nothing of the fact that these happen to be international waters. What is more, accurate location of the pilot tunnel from shafts perhaps 20 miles apart probably would require special instruments, although the absolute necessity for a meeting of opposing bores to fine limits is less for a pilot tunnel than for the traffic bores.

Physical conditions support economic studies favoring a rail tunnel over a road tunnel. A railway, in fact, makes the optimum use of the restricted space for transporting people and goods. As the existing railways on each coast are located well above sea level, considerable lengths of approach gradient will be needed to reach the necessary depth of the undersea sections of the tunnel. Ventilation requirements alone make the use of electric traction throughout the tunnels inevitable, and the underland approaches, if constructed on a one percent gradient, would not give rise to any difficulties with electric locomotion. But these approaches would require some 8 to 12 miles of new surface railways, together with a further 9 to 12 miles of new line in tunnels, according to the route chosen. These figures are the combined totals for the two sides of the Channel.

The tunnels, it is proposed, should have a 21%-ft internal diameter and be about 50-ft apart. Such a size would allow for rolling stock which is larger than that normally used in Britain and which is big enough to carry sizable road vehicles. However, it might be wiser to confine rolling stock for through journeys into Britain to the smaller gauge, even though it obliges continental authorities to provide special rolling stock of block trains for heavy, regular traffic. The smaller rolling stock would permit a smaller tunnel and provide a significant saving in the initial cost of construction. Furthermore, the continental authorities would, in any event, have to build rolling stock to suit the smaller British gauge, if through services are to be operated beyond the tunnel. The only alternative would be for British railways to rebuild platforms and other structures in the area to suit the larger size rolling stock, but this seems out of the question. On the other hand, it must be admitted that a smaller tunnel, though cheaper, would mean that there was a limit to the size of road vehicle that could be carried piggyback through the tunnel.

It was surprising to find the Channel Tunnel Study Group recommending 25 kv, a.c. overhead line electrification. Such a system would require tunnels with some 12 inches extra clearance over that required for a 750-v d.c. third rail system. The 750-v d.c. system is at present being installed on British railways in the area of the approaches to any Channel tunnel, and this work should be completed by June 1962. The extension of this system through the tunnel to the French portal seems logical, although it would require some six electrical substations along the undersea portion alone. Each of these would require an additional chamber about 50-ft square and 12-ft high. However, such installations can be left unattended for long periods and are very reliable in operation. Although French railways are electrifying lines in the north with high voltage overhead systems, the lines which would serve the tunnel are not scheduled for electrification in the near future. In any event, a short changeover section between third rail and overhead should not present any difficulties.

As an aid to draining the tunnel – for even slight seepage over such a length must involve considerable quantities of water – a longitudinal profile shaped like a shallow W is likely to be adopted. The outer arms will represent the land approaches, with the undersea section rising slightly to a mid-Channel summit. Drained water then would flow towards the dips beneath each coastline, where pumping shafts would be provided. Separate drainage tunnels probably would be necessary for safety reasons, during both construction and operation, and also to provide shorter routes to the sumps located at each coast. These drainage tunnels would be of considerable length and would not necessarily follow the line of the traffic bores.

Cost considerations nowadays rule out older forms of tunnel linings such as brick or cast iron segments. Recent railway tunnel construction in Britain has utilized a new form of lining employing precast, reinforced concrete segments which are interlocking and not bolted. These would need grouting for use in an undersea tunnel.

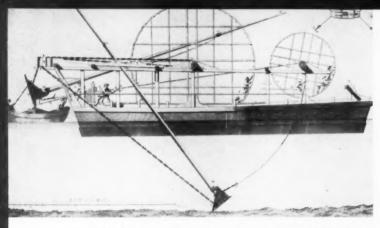
These, then, are some of the main technical problems confronting the builders of any tunnel bored under the English Channel.

#### Alternate Proposals

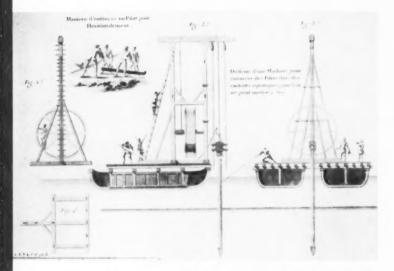
A tunnel is not the only means of linking Britain with the rest of Europe; neither, of course, need a tunnel necessarily be built by boring. One of the most promising alternate proposals so far put forward would employ preformed sections of tube, either laid on the surface of the seabed on a prepared foundation and protected by filling, or laid in an excavated trench and subsequently buried. With either scheme, the preformed tube sections doubtless would be of reinforced concrete. It would be difficult to keep the tubes watertight, and the risk of damage, willful or otherwise, would be high. This form of construction also seems likely to be more costly than a tunnel.

Other suggested means of crossing suffer primarily from nonengineering drawbacks, including higher cost without any compensating increase in capacity. Such schemes include a high-level bridge, at twice the cost of a tunnel; a floating bridge, with removable sections; a double dam enclosing a canal, but completely obstructing navigation except for locks at each end; and, bordering on the fantastic, a submerged jetty below the depth of the deepest ship's draught, on which would run some form of railed vehicle. Such suggestions all create greater or lesser obstructions to international waters, or create new navigational hazards and increase the likelihood of ships colliding in an already crowded waterway.

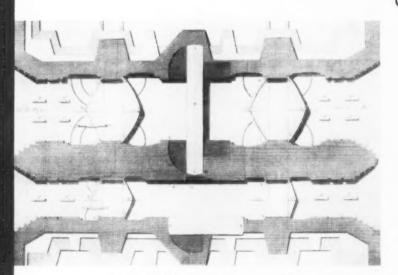
Thus, all the serious evidence points to the construction of a bored railway tunnel as being the most attractive solution for a vehicle link between Britain and the continent of Europe. It will be disappointing – from both an engineering and an economic point of view – if the Channel tunnel is not built after all.



Dredge at Toulon was powered by two walking-wheels.



Pile drivers, including horizontal and sea borne models.



Canal Mardick, with twin locks, revived Dunkirk harbor.

#### Bernard Belidor



## Ports and Harbors

JAMES KIP FINCH, Dean Emeritus Renwick Professor of Civil Engineering Columbia University

OOT until 1753 — some 16 years after the first volume of his magnum opus appeared — did Belidor complete Part II of Architecture Hydraulique. He prefaces these two last volumes with the statement that "of all the Arts to which necessity has forced man to apply himself, there is none of greater interest to society in general than that by which he brings under control the flow of water, to meet the different purposes which tend to enlarge his advantages." Belidor was a military engineer, and his primary interest was in the study of military projects. He gave special attention to a pressing French need — the harboring of ships of war.

Although Louis XIV had been successful in many military ventures, control of the sea had fallen into other hands. It is said that, by 1664, foreigners controlled not only the sea borne commerce of France but also that between French ports. Colbert, Louis' famous minister, who played a major role in the earlier engineering and industrial development of France,

had endeavored to correct this situation. In an effort to create a French navy Louis called upon Vauban to develop a great naval base at Dunkirk on the Channel. Later, as a result of the treaties of 1713-14, Dunkirk, which had become a thorn in the side of the English navy, was demolished.

#### Dunkirk

The jetties which Vauban built to confine the stream flow and create an entrance channel through the low, sloping sandy shore to the inner harbor basin at Dunkirk receive special attention. He notes they were "of an extent to which no work has ever been of this size, having been near a thousand toise [about 6000 feet] in length, all made of timber, the openings filled with great stones, following the best rules of mechanics, and built at prodigious expense." He goes on to explain that the normal flow of the stream entering the sea at this point was insufficient to scour out a satisfactory channel between the jetties. Therefore, gates were provided to hold back the stream flow so it could be released in sufficient volume to be effective. "To judge the marvellous effect of the preceding locks, in relation to the great length of the jetties, it suffices to say that between 1701 and 1710, one observes that they deepened to 15 feet the Port of the Channel."

The tidal range at Dunkirk also made necessary a tidal basin with double gates, to prevent the entrance of high tides or the discharge of the water in the basin at low tide. This involved constructing a passageway with one pair of gates facing out and another in. Belidor records the specifications for "the Great Lock at Dunkirk," noting 100 items; the contract and contract prices; and gives a table for estimating the volume of round timbers of 5 to 36 inches diameter, as a basis for payments to the *entrepreneur* (contractor).

The famous Risban and other forts at Dunkirk also are described. The former, a solid circular masonry fortress with embrasures for cannon, magazines for supplies and powder, and quarters for the garrison, had a high tower which served both as a *citadelle* and a lighthouse for many years.

#### Locks

Following this introduction, Belidor takes up "the use of Locks in general, with the explanation of their

principal parts." His study of what has been called the greatest of hydraulic inventions centered on its use in sea ports. He either did not know of or ignored small inland works — an Italian development of canal locks in the 14th century or earlier. Of the larger sea locks he states: "It is not two hundred years since the Hollanders invented great locks & learned how to use water in an infinity of circumstances useful to the needs of life; for we find nothing among the ancients, which is equal by comparison to the marvellous works with which Europe is filled today." While he describes navigable canals and their locks in Volume IV, he devotes Volume III solely to marine works.

We usually think of a lock comprising two gates with the lock chamber between. However, Belidor uses the term lock for almost any type of water gate — from what we now would regard as a sluice gate to the large framed timber mitering gates with iron fastenings used in entering a tidal ship basin. His studies further include the gates used to control river flow in low countries, and to flood low lands in defending cities against enemy attack.

In discussing the sea locks, Belidor attempted to reduce practice and experience to rules, as had Gautier and others. In this instance, he followed a plan which architects had adopted, thus: "As of now the size of the parts (of locks) has been purely arbitrary . . . we have reduced them to general rules, in the manner of those which have been established for the Orders of Architecture; that is to say, in imitation of the Architects, who divide the smaller half-diameter of the Column, into a certain number of equal parts, and from which they determine the (proportions of the) members of an Order; we have divided the size of Locks into 12 modules for fixing the parts, & following this fundamental plan, set up rules for the dimensions of timber, the strength of their ironwork, & that of the pieces of bronze which enter into their building, thus making it extremely convenient."

He advises that locks and gates be made no larger than use required. "When the Locks do not serve for navigation, but only to retain water, the opening is closed by sluice-gates, which one lifts or lowers to permit the passage of the water, or retain it in whole or in part; these are the Locks ordinarily used for mills & to control inundations. . . . When the width



An inclined plane handled ships dry-docked in Mediterranean. Dry docks were above low tide level to be self-draining.

of the opening is not 8, 10, 12, or 14 feet or more, we sometimes employ but a single sluice-gate to close the Lock; & raise it by the aid of cables, which are coiled on a windlass, which is turned by means of great arms, attached to its ends, which many men maneuver." He goes on to explain that when a lock is used for navigation, sluice-gates are inconvenient and swinging gates are preferable.

#### Lock Walls

Belidor correctly computes the overturning moment of water pressure acting on a lock wall. Assuming that "an infinitely little length" of the wall can be considered if the wall is "of a uniform quality, and since this uniformity is essential in all works properly executed," he analyses a unit length of a rectangular wall of height b, of width y, and weighing 120 livres per cubic foot, subjected to the pressure of water weighing 70 livres. "Since the area of the triangle of water pressure comprises all the pressures which tend to turn over the rectangle of the wall, to provide a counter movement, about its outer corner point, which is the fulcrum, the area of this rectangle, by reason of its weight, must be imagined as concentrated in a force acting vertically through its center of gravity." Equating the moments of water pressure and wall he derives correctly the rule: "Cube the depth of the water, divide the product by 5 times the height of the wall, & extract the square root of the quotient; this root gives the thickness we must have for the wall." It is interesting to note that he resorts to the use of calculus in computing the moment of the simple triangle of water pressure, perhaps to impress the reader with his mathematical understandings. He also suggests that, while this rule provides all that is necessary for equilibrium, it should be modified to provide a wall thickness that will give moments in the ratio of 3:2.

Dry docks especially posed great problems in securing reasonably water-tight side walls and bottom. Belidor states "it is of great importance to make an effort so that the water which gathers will drain out itself at the time of ordinary low tide, without making it necessary to use continually a great number of machines for pumping." He advises placing the bottom of a dry dock about a foot above low tide to make it self-draining, although it could not be entered except at high tide. The Mediterranean, with low tidal range, posed difficulties which he proposed to meet by using an entrance lock chamber into which water could be pumped to raise a vessel to a high dry dock for repairs or refitting.

#### Tides

Volume IV opens with an interesting *Dissertation sur* le Flux & Reflux de la Mer, a study of tides. This is followed with methods for making rivers navigable:



Tour de Cordouan, probably the first lighthouse in modern Europe. Originally lighted with wood, it later used coal.

descriptions of canals and their aqueducts and culverts, and also swing bridges; and notes on drainage and irrigation. "Thus young Engineers, having occasion to undertake these things which we report, will make important progress through Architecture Hydraulique, because of the way in which we have treated these works, finding here the designs and specifications which they must follow, also the modifications to allow for in their work, which are difficult to secure, not having some data such as that we cite. . . . Is it not a great advantage," he asks, "for those who have the desire to prepare themselves by an understanding of the works which have been executed by the most able men, to profit at the same time by their mistakes, and to avoid those which they are in danger of making? . . . We shall be happy if this work fills this need we have suggested, in offering to our Descendants the proper maxims so that they may carry forward for better the models which they will find here."

#### **Dredges**

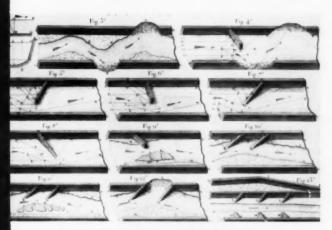
In connection with the necessary machines for marine work, Belidor describes at length the operation of "a machine to clean the Ports of the Sea," a dipper-dredge operated by man power. He states that this particular machine was made in the Arsenal at Toulon, but the device probably originated in Holland. In addition to its use in harbor work "it serves very usefully & most economically for a great number of other purposes, such as for the digging of foundations, navigable canals, or ditches for drainage." He also shows a simpler form used in making ready a sheet-pile coffer-dam for foundations. This is followed by plans for a bottom-dumping box for depositing a lime-pozzuolana concrete under water. The caisson method followed by Labelye in building Westminster Bridge over the Thames at London also is described. A familiar method, used at Toulon to build an inclined ship-way up which a vessel could be drawn for dry-docking, is likewise noted, as is another at Rochefort "for vessels of the first rank."

#### The Tower of Cordouan

Belidor includes a description of what has been called the first lighthouse built in Europe, "the famous Tour de Cordouan, located on a rock forming an Isle in the Sea at the mouth of the Garonne, to facilitate the entrance & exit of Ships into the two Rivers Garonne & Dordogne." Two miles from the port of Bordeaux "this magnificent tower, rising 169 feet above its foundations, was built by Louis de Foix, celebrated French architect, who began it in 1584, & finished it in 1610 . . . four Guardians attend constantly to lighting the fire of the lantern, serving for six months & supplied with ample water by the rain which falls on the Tower & is collected in a cistern." Through long use, the fire used for light calcined the side walls, and a new lantern - using iron instead of stone - was built in 1727. Later, the first Fresnal lenses were used in this tower.

#### Stream Flow

The mechanics of flow in streams, rivers, aqueducts, and canals long baffled early workers. The Roman neglect of velocity had been corrected, but it was not clear what created velocity in open channels. Although it was evident that a sloping channel was necessary for flow, it was erroneously assumed that velocity increased with depth. Belidor states: "It is extremely important to realize that the slope does not suffice to cause the water to flow, it is necessary to consider its fluidity, which means that one part of the flowing stream cannot be retarded a little without the others also being affected, because since the flow takes place at a certain depth, the higher columns press the lower, & they give a degree of movement



Belidor, and later Chezy, studied "spur dikes for restaining the progress of the erosions which occur in Rivers."

equal to that which they would acquire by a fall having a height equal to that of the columns; which shows that the deeper the water the higher the velocity." He concludes that "in the streams which have little slope, the speed nearly always results from the depth of flow of the water & when on the contrary in those which have much of a fall this slope gives somewhat more than the depth of water to render the flow rapid, as that attained by torrents." However, he realized the possible effect of friction on velocity distribution, for he notes: "The waters of springs coming together to form a River, are accelerated in their movement, since their bed is in the mountains which gives a very great slope, but after having reached a certain distance, the speed is reduced close to uniformity by the diminuation of this slope, & the resistances presented by the bottom & the sinuosity of its banks, which are especially effective in destroying the larger part of the speed it has acquired." In this connection the effect of epis des bouts, or spur jetties, in deflecting the current and reducing erosion also receives attention.

#### Canals

Turning to canals, Belidor recalls "the most celebrated Canals for navigation executed by the Ancients," and describes especially the great Canal of Languedoc, which crossed from the Atlantic to the Mediterranean just north of the Pyrenees. Begun in 1666 and completed in 1681, "of all the great works which were executed in the glorious Reign of Louis XIV, there is none more useful, more magnificent, nor of greater honor to the spirit of man, than the Canal des deux Mers." Other sources offer a more complete description of this great work, with its tunnel at Malpas and its reservoir for summit water supply, but Belidor does record the construction by Vauban of a number of "aqueduct-bridges" by which the canal was carried over intercepting streams and improved in alignment and operation. He also refers to the first canal to cross a summit, the Canal de Briare, of 1642, which joined a tributary of the Seine with the Loire. In describing the Somme-Oise canal, he offers "rules pertaining to canal projects, locks, aqueducts, culverts, bridges, and other canal works."

Belidor finally closes his work, which can only be described as monumental and encyclopedic, with the statement:

"I here at last arrive at the time when I must propose to send forth this Work, I admit frankly that it has caused me much labor, & that it has been only my interest in the Public welfare that has made it possible for me to sustain my perseverance for the 34 years during which I have been so engaged. I wish that it may serve the purpose for which I have intended it, & that it will greatly aid in giving rise to improving more and more an activity so useful."

#### How sewage pumping is made easier with an Ampli-Speed magnetic drive

by Warren J. Birgei

Electrical Engineer Electric Machinery Mfg. Company

For years a common method of varying the speed of sewage pumps to match flow rate was by use of woundrotor induction motors. In recent times, however, a new



W. J. Birgel

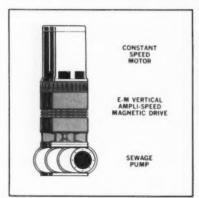
electrical device has won wide acceptance for its efficient speed control capabilities. This device is the eddycurrent slip coupling, or magnetic drive.

With a magnetic drive installed between a constant-speed motor and the pump, pumping speed is adjusted with a simple potentiometer control.

The constant speed electric motormagnetic drive combination provides an all-electric system that offers distinct advantages in planning new pumping installations or in redesigning older ones. Here's how:

Smaller Wet Well. With a magnetic drive on one or more pumps, the wet well or grit chamber can be made 25-35 % smaller because it must handle only average flow, rather than maximum flow. With constant-speed drivers, the wet well must be designed for maximum flow.

Improved Plant Performance. With adjustable speed pumping, sewage feed through the plant is more even . . . the surging associated with

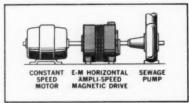


VERTICAL INSTALLATION requires no more floor space than constant-speed motor. Magnetic drive becomes integral with motor. E-M builds vertical Ampli-Speed Drives in a wide range of ratings.

In some cases, this makes it possible to avoid kilowatt demand penalties.

Less Pump Wear. With constantspeed pumps, the sudden-start surging of sand and gravel into the pump can often damage the impeller and casing rings. With a suitable automatic control system and magnetic drive, grit does not settle out because pumping is continuous. Abrasives move into the pump in suspension, with far less chance of pump damage.

Permits Plant Expansion. Expansion flexibility is inherent in magnetic drive pumping. The automatic control system can be easily enlarged to include other pumps in sequence.



HORIZONTAL INSTALLATION is compact. And air-cooled Ampli-Speed requires no complex cooling system, may be installed and treated like a motor. E-M builds Ampli-Speed Drives to fit all pumping applications.

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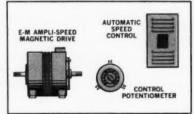
Precise, Stepless Speed. Output speed held to close tolerances. Provides smooth, stepless speed changes.

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> Easy Maintenance. No heavy brush currents . . . no electrolytes.



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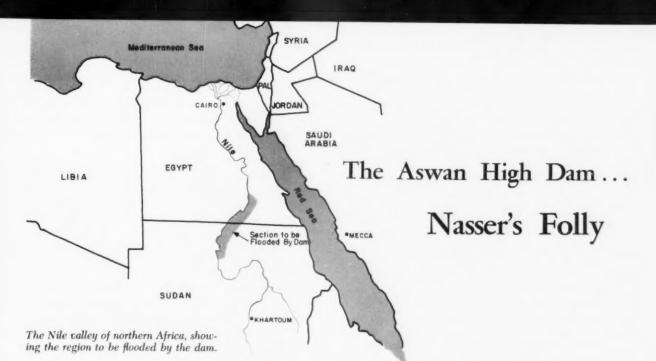
Ampli-Speed is available for either vertical or horizontal installations. with wide range of input speeds. And E-M has designed applications through 800 hp.

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F. C. LIVINGSTONE CE London Correspondent



The original Aswan Dam was built in the mid-Thirties at a cost of \$20 million. The dam, over a mile and a quarter in length, crosses the entire Nile valley.



The Temple of Isis at Philae, one of many that will be destroyed if the Aswan High Dam is built. The old dam now floods the temple during parts of the year.

On January 9, 1960, United Arab Republic President Gamal Abdel Nasser plunged a detonator, setting off 50,000 tons of dynamite in the Nile ravine near the First Cataract. This was to be the symbolic beginning of work on the Aswan High Dam, one of Nasser's most ambitious promises to his people.

Since that day - more than a year ago - nothing has been done.

The heavy earth-moving equipment still is sitting idle in the sun, and the Nile continues uninterrupted its journey north. In the streets of Cairo, little is heard of the great dam that is to bring new life and prosperity to the land. Nasser is in an awkward position, but refuses to admit it. There are, as it now stands, objections to the Aswan Dam far more compelling than the arguments for it. In fact, the major item in favor of the dam seems to be Nasser's pride.

American engineers started to help Egypt with the project. Then, when surveys showed the practical objections and sober deliberation revealed the political objections, they dropped it like a hot penny. Soviet engineers immediately rushed in and picked it up; all they have to show for it so far is burned fingers. At latest (unofficial) reports, the Russians had convinced Nasser of the impracticality of his scheme, and talked him into settling for a series of smaller dams. However, nothing has yet been done on these.

Three factors have come to light in studies for the dam — three strong arguments for not building the dam, now or later.

#### Water Losses

The first objection to the Aswan Dam is its potential inefficiency. Doctor Abdel Aziz Ahmed, former consultant to the Ministry of Public Works in Egypt and chairman of the State Hydroelectric Power Commission, has warned that the proposed dam would not control

the waters of the Nile, it would only divert them — perhaps to the Red Sea. Doctor Ahmed said that the extremely dry Nubian Plain, and the faulty geological structure of the area behind the dam, would cause enormous water losses through evaporation and seepage. Experience with the existing Aswan reservoir has shown that the region is not suited to large storage dams. More water is lost than can be replaced by normal flow.

Apart from the structural risks, there is the very serious problem of silt loss. The annual Nile flood from the highlands of Ethiopia brings the fertile top soil that is the basis of Egyptian agriculture. It is feared that the High Dam would hold back most of the rich silt, depriving the lowlands of an essential ingredient of their economy. In addition, loss of the silt would mean the Nile would flow clear to the sea. It then would erode rather than deposit material, adding to the problem enormous-

ly. In time, the entire Nile delta would be washed away — in 50 years, Alexandria would be on an island 10 miles off the African shore in the Mediterranean Sea.

#### Flooding

The second big objection to the Aswan High Dam is the region which would be flooded. The artificial lake would extend about 300 miles south from the First Cataract - almost to the Third Cataract. Much of this region is not Egyptian, it is Sudanese. The government of Sudan has not taken kindly to the indiscriminate flooding of some hundred miles of its border land, particularly since that hundred mile region includes the important city of Wadi Halfa. The two governments have reached some sort of tentative agreement on the matter, but feeling among the people of Sudan is reported strong against the dam.

More important to the rest of the world is the historical signifi-

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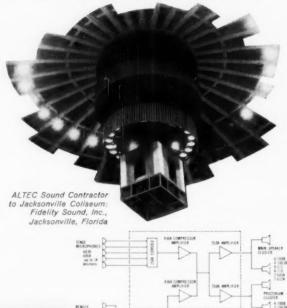
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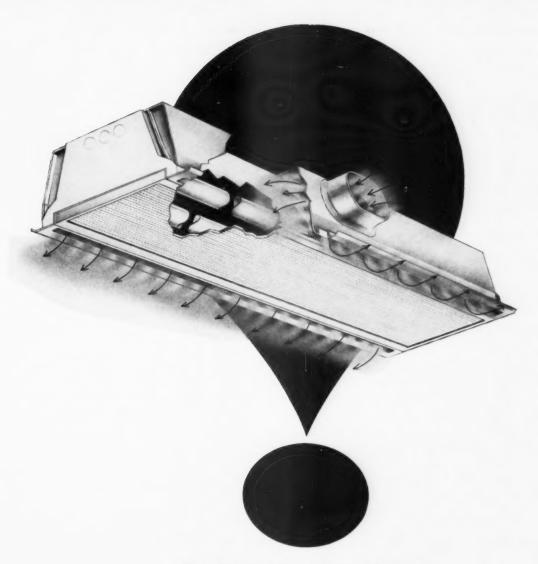
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cance of the area to be flooded. At least 200 major sites of archeological, historical, and cultural importance would be inundated completely by the new dam. Some of them already are flooded part of the year by the present dam. Building the High Dam would destroy all of them. Several organizations, including UNESCO, are trying to provide some means of preserving these sites, but all plans suggested to date have been far too costly.

#### Disease

Professor H. van der Schalie, a University of Michigan zoologist, has described the dam, with its lake and irrigations systems, as an ideal instrument for the spread of a schistosomiasis epidemic. This disease, most prevalent in under-developed countries, affects the liver and intestines of men and animals, causing pronounced weakness and often lack of virility.

Schistosomiasis is carried by a blood parasite which infects snails. The building of the first Aswan Dam proved its danger. The rapid flooding, then drying, of the region near the dam caused a large increase in the snail population. As the snails increased, so did the schistosomiasis. Professor van der Schalie says the building of a new and higher dam would cause another, more severe epidemic.

The disease itself is not the final objection. Men who are afflicted with schistosomiasis - or bilharziasis, as it is sometimes called are unable or unwilling to work. So, as the work continues, the disease spreads; and as more men are affected by the disease, laborers are harder to find, both for the work on the dam, and on the farms created by the dam. Further, bilharziasis sufferers often turn to hashish, either for escape or for its alleged aphrodisiac properties. Immediately after the first dam was built, the drug traffic into Egypt reached alarming proportions. Professor van der Schalie points out that the new Aswan Dam would almost certainly repeat all this.

#### Cost

As originally planned by Nasser, the Aswan High Dam would cost about \$700 million, and would be, at best, a dubious improvement over present conditions. The reports from the Near East indicate that the Russian plans for a series of smaller dams would reduce the cost by up to 40 percent. In addition, smaller dams, located with consideration for the geological structure and climate, would result in less loss through seepage and evaporation. However, the dam was a political promise, and Nasser may yet feel compelled to go through with it, if only to save face.

The target date for the dam was to be 1967. But, as things stand at the present time, not even a crash program could get it built before 1972. Many intelligent Egyptians, moreover, are quietly hoping it never will be built.



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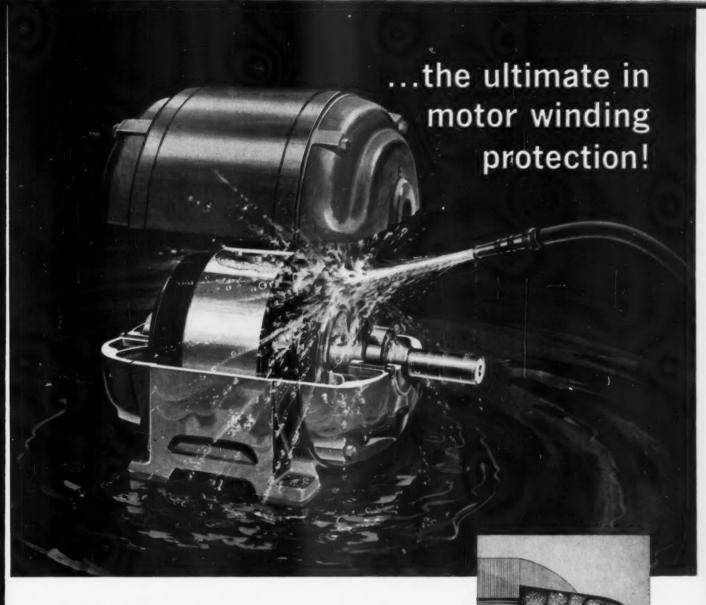
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# CEC Budget Provides for Executive Director



CEC's new executive group includes (from left): George J. Toman, secretary; Hueston M. Smith, immediate past president; Harold P. King, president; Cedric R. Acheson, 1st vice president; George W. Poulson, treasurer; Sanford K. Fosholt, 2nd vice president.

On SATURDAY, May 6, the board of directors of Consulting Engineers Council approved an annual budget in excess of \$100,000. It followed hard on the heels of Ralph M. Westcott's past president's committee recommendation that the Council employ a fulltime executive director. Thus, the \$100,000 budget figure is much less important than the fact that within it is a provision for the salary of a new and important full-time employee. It may take some time to find the right man, but CEC knows what it wants and quite evidently is willing to pay for it. Here are some of the qualifications for the man they seek:

¶ Full knowledge of CEC, its historical background, actions to date, established and implied policies, and future objectives.

¶ Ability to meet with other organization representatives with full conviction of the merits of CEC objectives — yet capable of constructive negotiation.

Ability to get good public reception as a speaker on behalf of the Council.

¶ Willingness and ability to do extensive traveling.

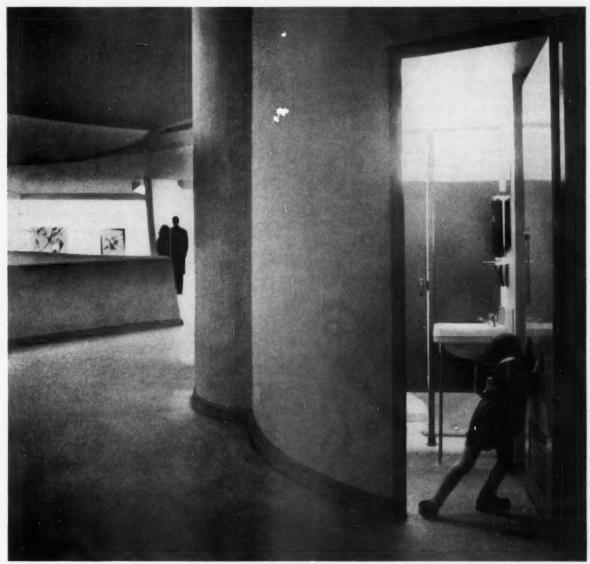
¶ A good background, either with a consulting engineering firm or in association management.

It should be emphasized that the advent of this new position in CEC's central office will bring additional burdens to the present staff - particularly Larry Spiller. On Larry's broad shoulders will fall the additional burden of a centralized public relations program. Lack of adequate communications and funds has hamstrung the professional firm which has served CEC on a retainer basis during the past year. While this firm still will be called in for specific assignments, the major burden of the Council's public relations program now will have to be borne by Larry Spiller and his Springfield staff. Certainly, they are "in the know" on Council affairs, but it still will take a great deal of time and money for them to do an adequate job. It is encouraging to note that the board of directors is well aware of this and is prepared to employ additional office help and provide adequate quarters.

Closely associated with the decision to hire an executive director is the problem of relocating CEC offices in Washington. Some state associations may be disheartened by the fact that this move again has been delayed. However, aside from the matter of prestige, there seems to be no point in taking on the additional financial



CEC-Producers' Council awards luncheon saw Inland Steel Products Co.'s Tom Bennett receive award for advertising campaign in Consulting Engineer from Hueston M. Smith. John Haines is at left, and Jack Bjorkholm is at right.



Crane in the world's most talked-about museum. New York's spectacular Guggenheim Museum features a permanent collection of Crane fixtures. They are spotted strategically on six levels of the great ramp that spirals nearly a third of a mile around. In all the convenient washrooms gallery-goers, critics, artists and sight-seers find the familiar comfort of Crane. For beautifully styled plumbing fixtures and the finest brass fittings, Crane has been a five generation favorite. Undisputed quality, contemporary design and availability in a wide range of styles and colors make Crane the choice of architects and engineers. Builders and owners accept Crane quality with confidence. Crane Co., Plumbing-Heating-Air Conditioning Group, Box 780, Johnstown, Pennsylvania.

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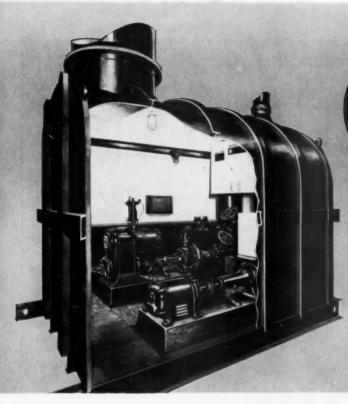
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burden of office relocation at this time - even though everyone agrees that a Washington office would be a fine thing. As a matter of fact, the move may not be too far in the offing, for there is presently under consideration a plan for erecting a Washington office building in which CEC, as well as other engineering organizations, would be able to lease adequate space in a desirable location. The promotion of this plan will take a little time, but it may be well worth it in terms of economy and national prestige.

One of the highlights of the 1961 annual meeting was the awards luncheon for the Consulting Engineers Council-Producers' Council, Inc. Engineers' Technical and Product Literature Competition. This competition, the first significant national effort to point up the needs of consulting engineers to manufacturers of the equipment and building materials which they specify, should prove invaluable to the consultant, both in terms of national recognition and the availability of useful engineering data. Certainly, the members of the Producers' Council are to be congratulated for their awareness of the special need of the consulting engineer. It is hoped that other manufacturers will get the message.

It is no secret that professional liability insurance for consulting engineers has recently become a losing proposition for the insurance companies. It is also no secret that this has not come about through the activities of consulting firms with high standards of professional performance. It is, therefore, a measure of the competence of CEC member firms that one company still is willing to work with CEC in this highly chancy field. Insurance companies enjoy working with "good risks," and apparently CEC members qualify.

For a long time CEC has been actively engaged in the promotion



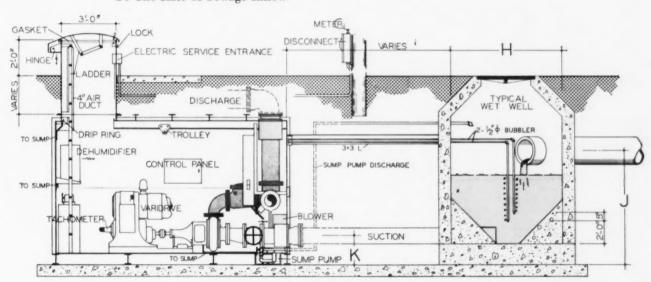


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of private enterprise, not only as a matter of self-interest, but, more significantly, as a matter of principle. In an era when free enterprise is under attack from many quarters, it is not surprising that CEC's private enterprise program is getting quite thoroughly entangled with all of the many CEC committee activities. This is the kind of problem that Harold King and his new executive group may find best to leave unsolved, even though it does cause an occasional overlapping of function and duplication of effort. Certainly, the private practice of engineering cannot survive if every individual member of Consulting Engineers Council is not actively and aggressively engaged in the promotion of free enterprise.

To date, the most aggressive effort has been sponsored in Oklahoma — followed closely by Oregon. It is encouraging to note that other member associations are planning to take similar action. If this ground swell continues, consulting engineers soon may be an important factor in the growing effort to trim big government down to size. However, CEC is well aware of the fact that these efforts can succeed only if pursued as a matter of principle and not as a matter of self-interest.

This year's annual meeting was held at the Executive House on Chicago's near North Side. It is a pleasant place, and although there were the usual minor inconveniences, the Chicago Association of Consulting Engineers proved to be an excellent host. It is, perhaps, not fair to single out only a few, but the families Evanson, Wolff, Nettnin, Abramson, and Klipp will certainly be remembered by the delegates and alternates, as well as their wives. We hope too that John S. Bereman, of Wyoming, will have fond memories of Chicago. He came as a delegate of the Practicing Engineers and Surveyors Association of Wyoming, 33rd member organiza-

# where POWER is VITAL



# ASCO AUTOMATIC TRANSFER SWITCHES help insure the safety of New York's subway millions

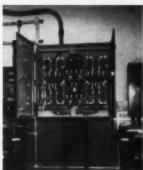
More than 4½ million commuters use the New York City subway system daily during the working week. Their safety is a major concern of the New York City Transit Authority. That is why the NYCTA insures against power failure with stand-by power. When normal power fails, ASCO Automatic Transfer Switches automatically transfer the load to the emergency source.

The Transit System's new and modern station at Grant Avenue in Brooklyn, N. Y., is typical. There ASCO switches assure continuous adequate-voltage power for a wide range of equipment: train signals, safety devices, station lighting, ventilation and drainage.

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Wherever power and dependability are vital, ASCO switches provide these notable advantages: continuous duty rating in either normal or emergency position...capacity to withstand inrush currents 20 times full load rating...rated 750 volts A-C or D-C...mechanical locking to safeguard against vibration and electromagnetic effects...single coil design...built-in time delay so that equipment ignores harmless momentary outages...full phase protection, high thermal capacity, and many other design features and accessories. That is why safety-minded engineers specify ASCO – the one source for a full line of dependable automatic transfer switches. Write for Publication 596 on how to select an adequate automatic transfer switch.

# Critical Subway equipment depends on continuity of adequate voltage power



At the Grant Avenue Station of the NYC subway system, this electrical distribution room features ASCO Transfer Switches which "throw in" emergency power for station and tunnel lighting and safety devices.



Safety trip which prevents train from passing through red lights relies on ASCO switch for emergency power.

#### ASCO Electromagnetic Control



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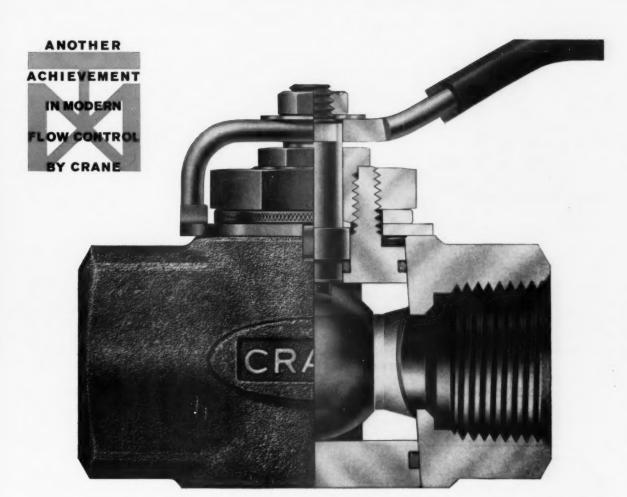
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John S. Bereman, representing the Practicing Engineers and Surveyors Association of Wyoming, is welcomed by George Toman and Hueston Smith.

tion to be accepted in the Consulting Engineers Council.

For Hueston Smith, the 1961 annual meeting meant the end of a long and arduous year spent in the promotion of CEC, and the chance to return to his first love - the private practice of engineering. The same was true for Fred Steele, Les Bosch, and Ralph Westcott all veterans of many years of service to the Council. For Smith the respite is a brief one, for he will remain active as the immediate past president. George Toman remains for a second tour of duty as secretary, while Harold King advances from first vice president to president. Cedric Acheson takes over as first vice president, Sanford Fosholt as second vice president, and George Poulsen as treasurer. These men are all dedicated to the advancement of CEC. but it is hoped that their burden will be eased just a little bit by the expansion of the central office and the early employment of an executive director. The Council cannot always depend on so few to do the work of so many.



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**CRANE BALL VALVES** are engineered for superior flow control and minimum-maintenance operation. The secret of this valve's all-around outstanding performance is its beautifully simple, Crane-designed tapered cartridge containing all the working parts. While the valve body remains in line, acting as a pipe connection, the entire cartridge may be removed from the bottom, quickly and easily, for fast exchange or simple, low-cost maintenance.

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## The High Spots

#### Growing a Town

As a class project, a group of civil engineering students at Syracuse University developed a program for expanding the town of Dexter, New York. The project began as a discussion of the opportunities offered by the St. Lawrence Seaway. Professor P. J. Brennan, chairman of the civil engineering de-

partment, told his students to determine the necessity of a port on Lake Ontario, and to draw up plans for its construction.

The students decided a new port would revive industrial and economic growth of Central New York, and chose the Watertown suburb of Dexter as the most likely spot for the new port. The study concluded that \$158 million would be needed to develop and expand Dexter from a residential town of 1000 to a formative industrial town of over 10,000. There has been no indication of the reaction among the present citizens of Dexter.

#### Experts' Per Diem

Paul Robbins, executive director of NSPE, has urged the appropriations committees of both the Sen-



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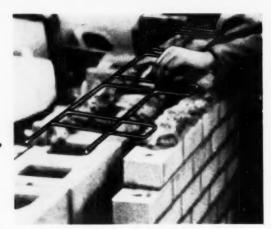
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ate and the House of Representatives to approve maximum per diem rates of \$100 for experts and consultants temporarily engaged by government departments and agencies. Robbins cited present rates of \$50 or \$75 as inadequate for the economically feasible performance of consulting engineers. He explained to the congressmen that the result of a Federal limitation of less than \$100 could be that "most qualified engineering firms would refrain from undertaking projects for the government, leaving the government's choice to less qualified consultants."

#### **Prestressing Methods**

T. Y. Lin, head of the California consulting firm of T. Y. Lin and Associates, and Professor of Civil Engineering at the University of California, recently lectured in Great Britain on concrete developments in the United States. Lin, vice president of the International Federation of Prestressing, ex-

plained to the Prestressed Concrete Development Group his own applications of prestressing techniques. The British were most interested in the use of two-way prestressed slabs, and in the concept of three dimensional prestressing as presented by Lin.

#### Corrosion in the Courts

According to David Hendrickson, corrosion engineer associated with The Hinchman Corporation, consulting corrosion engineers, of Detroit, corrosion was an important factor in a recent California case.

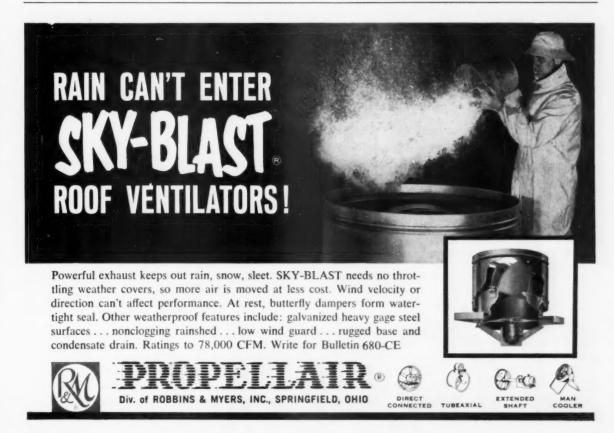
The contractor installing new sewer mains for the city of Richmond, California, encountered excessive water in his excavations, causing him an additional expense of almost \$100,000. The excessive water came from leaking and broken water mains of the East Bay Municipal Utility District, and the contractor sued the utility for damages. The resultant court action involved several engineering pro-

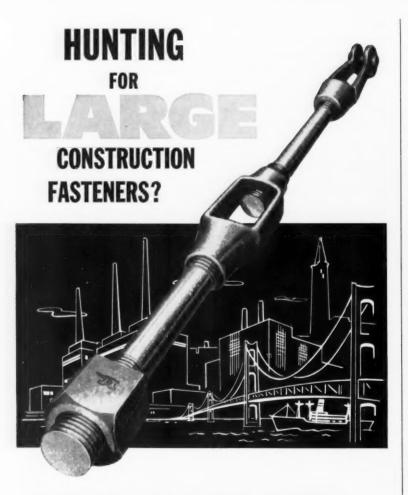
fessions, including corrosion, structural, soils, and drainage experts, in addition to construction and geological experts. A judgment was rendered against the Utility District for a part of the damages claimed by the contractor.

One of the complications in the case was a cathodic protection station, installed by the Pacific Gas & Electric Company to protect its gas mains in the area. Since the gas mains ran adjacent to the water mains in some areas, the question arose whether cathodic current from the PG&E station could have caused excessive corrosion in the water mains. Almost complete lack of information on this subject added to the confusion and length of the trial. The final judgment came only after a 12-week trial.

#### Colorado Legislation

Strong opposition by Colorado engineers has defeated a state law which would have required that subdivision plats be made and filed





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DYSEN

by registered land surveyors. Proponents of the bill claimed that the existing law permitted surveys and maps to be made by any registered engineer, regardless of his field.

The Colorado engineers pointed out the engineering aspects of maps and surveys, and added that surveyors were liable to a fine for performing engineering work. The objection pointed out further that the bill would place unfair restrictions on the practice of engineering in the state. After copies of the objection were sent to every member of the State House of Representatives, the bill was defeated.

#### **Exhibition Centers**

Showcase, Incorporated, of Birmingham, Michigan, has announced plans to construct and operate a network of building industry exhibition centers in 30 cities across the country. The centers, to be known as "Showcases," will be built within Kaiser Aluminum domes. The first one is being built in Detroit.

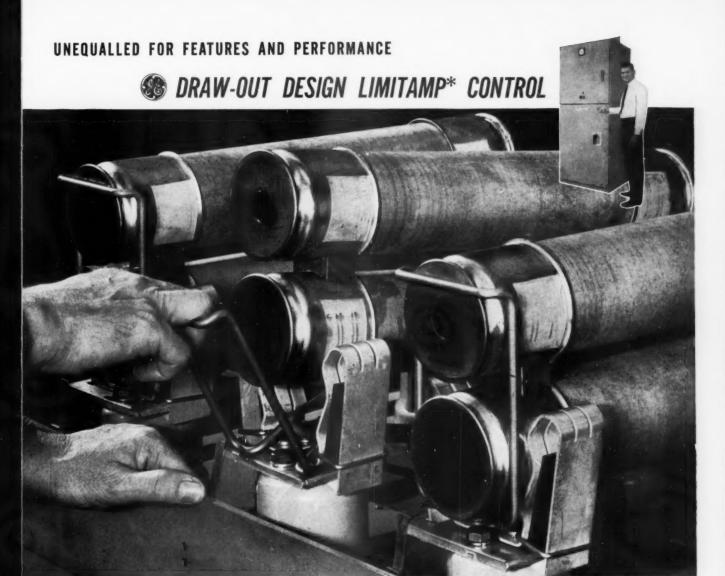
Showcase is planned to benefit manufacturer, dealer, specifier, and consumer, by providing market research, promotional services, and information services, as well as exhibit space for the industry.

The geodesic domes housing each "Showcase" were designed by Don Muntz, of Mason, Muntz, and Associates, Los Angeles. Each site will require about 10 acres, and will provide 460 floor display areas in addition to the supplemental services. The domes are being fabricated and erected by the R. C. Mahon Company, of Detroit.

#### Polyethylene Uses

According to a recent study by the U.S. Industrial Chemicals Company, polyethylene is becoming an increasingly important factor in highway and airport construction in this country.

Right now the most common use of polyethylene is as a cover during the concrete drying period on roads and runways. Its flexibility,



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Performance of the draw-out contactor is outstanding under all load conditions—from small motors running light to large motors at "locked rotor." A new blow-out structure and an improved arc chute with superior extinguishing action provides this improved performance. What's more, the new Limitamp contactor meets a 60-kv base impulse level.

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Industry Control Dept., Salem, Va.

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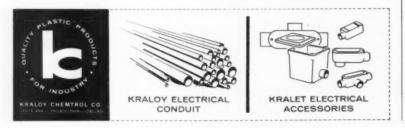


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Your Kraloy electrical distributor will elaborate on the above features . . . or write

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lightness, and effectiveness as a water barrier have made it a heavy choice over other curing covers. Another advantage of the product is its availability in several lengths and widths.

Polyethylene also is being used in tape form to protect sawed joints during curing, and in extra-thin sheets as a moisture barrier beneath concrete slabs.

#### Flame Spread Index

Hoping to clear up such vague product claims as "flame-retardent" and "fire-resistant." the Fire Research Section of the National Bureau of Standards has developed a new flame-spread index. This index is a relative measure of surface spread of flame, or, conversely, the resistance to burning of any material that may be exposed to flame or intense heat. The flame-spread index value indicates within narrow limits the relative flame-spread hazard of any material, compared to known materials such as wood and cement asbestos board. The index also can be applied to adhesives, coatings, and insulation.

#### **Engineer Shortage**

The magazine Dun's Review and Modern Industry has joined the growing list of worriers about the future of engineering in this country. The magazine has predicted an imminent and drastic shortage of engineers, particularly in the less glamorous industries. For example, companies making missile components will have less trouble finding young engineers than companies making kitchen sinks.

Dun's Review blames the prospective shortage on the relatively small number of freshmen entering engineering schools, and says industry itself is at fault for not encouraging more young men to enter the profession.

One of the unexpected side effects of the sudden clamour for engineers has been the skyrocketing of starting salaries. Many companies now find they have to pay



At the heart of every Graver MONOVALVE Filter is one butterfly valve—the one valve so important that it gives the filter its name. With a flip of its "wings" it performs the vital function of directing water to the filter beds, or sending it past them.

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Accelerated life tests conducted with the MONOVALVE Filter have shown no effects of wear or fatigue after the equivalent of twenty years of service.

The versatile MONOVALVE Filter can be obtained in single or multi-compartment units. Write for Bulletin WC-130, to discover its applications for your filtration problems.

Industrial Department I-333

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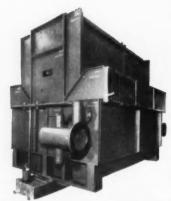


Graver Water Conditioning Co., 1961

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With the Niagara After Cooler the heat of compression is removed and dispersed into the atmosphere by the evaporation of a very small amount of water. The compressed air temperature is always brought below that of



the atmosphere surrounding your air lines, so that no further condensation can take place.

Large users of compressed air for plant services or processes choose Niagara Aero After Coolers for their dependable durability. They have been making good records of service for over 25 years.

Write for Bulletin 130.

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more to get beginning engineers than to hold experienced ones. This is particularly true in the fields of advanced technology, where the body of formal knowledge is a constantly shifting, increasing factor. In these fields, a college course may be obsolete two years after it is taught.

In the article, the magazine also cites the growing awareness of a professional feeling among engineers, as the societies step up their campaigns for professional recognition and publicity. They feel that if engineering can once more become a highly respected profession, more young persons will be attracted to it.

#### **ACI** Awards

Two consulting engineers were among the five engineers given awards by the American Concrete Institute at its Annual Convention. The two consultants are Anton Tedesco, of Roberts and Schaefer, New York; and Robert Williamson, of Holmes and Narver, Los Angeles.

Tedesco received the Lindau Award for "his outstanding contributions to the development and use of long-span concrete structures, as exemplified by the thinshelled arch." Doctor Tedesco, a vice president of Roberts and Schaefer, also was elected to the ACI Board of Directors.

Williamson received the Wason Medal, awarded for the most meritorious paper published about concrete during the year. The winning paper was "Performance and Design of Special Purpose Blast Resistant Structures," which appeared in the ACI Journal, May 1960.

#### Contractors' Cost Guide

The Associated General Contractors of America has announced publication of a *Guide for Field Cost Accounting*. The guide was compiled by AGC after consultation with 80 of its largest member companies. AGC felt that the relatively high rate of business failures in the construction industry

for easy field assembly.

# There's no fine print in Onan's pricing policy!

'Strip-downs' and 'price-adders' are getting out of hand in the electric plant industry. There have always been a few who have sold strictly on price, and of course, got the price down by stripping equipment of essential components.

Today, some leading manufacturers are stripping-down their electric plants.

These stripped-down prices *are* attractive. But when you add the cost of such essentials as oil and water pressure gauges, battery-charging ammeter, over-speed shutdown,

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Onan has never produced a stripped-down model, has never used essential operating accessories as 'price-adders.'

Today, more than ever, it will pay you to go over electric plant prices with an eagle eye. Compare Onan prices with others before you buy. (But read the fine print.)

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demanded a study of the problems faced by contractors, and how the problems have been solved.

The booklet is presented in three parts: preparation of the project estimate; job labor and material cost; and preparation of cost reports. While not advocating any one accounting system, the book suggests strongly that the contractor establish some definite system of accounting, and adds that this alone could be a company's most profitable investment. Copies of the Guide are available from AGC headquarters, 1957 E Street, N. W., Washington 6, D. C. The cost is \$2.50 a copy; \$1.25 to members.

#### Concrete Research

A recent issue of the University of Illinois Bulletin points out that the engineer must understand the capabilities of his materials if he is to predict their behavior in new and unusual applications. The Bulletin continues that the key to predicting the behavior of concrete is an understanding of the basic structures and properties of the cement gel.

Understanding of the cement gel has been developed only in the past ten years, and has far to go. Furthering this understanding is the goal of the second Conference on Fundamental Research in Plain Concrete, to be held at the University of Illinois this fall. The first Conference, three years earlier, was a definite success.

#### Canadian Salaries

The annual survey conducted by the Corporation of Professional Engineers of Quebec, Canada, shows the median salary for consulting engineers in the province is down slightly from last year, while the median income for all types of engineers combined is up slightly.

The results of the survey, published in a recent issue of the organization's Bulletin, give a median salary for all Quebec engineers of \$8500. Consultants' median income was \$8400. However, while the average consultant in

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Write for Bulletin CE-6

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BOILER SAFETY DEVICES Quebec may earn less than an engineer in industry, the man at the top of the list earned as much as, or more than, his opposite number in industry. For example, the median income of consultants who graduated in 1930 was \$13,000, considerably above the figure for nonconsultant engineers who graduated in the same year.

#### \$10 million for Engineering

The proposed budget for the Army Corps of Engineers civil works program includes \$10,278,000 for "advance engineering and design" — approximately 11 percent out of a total budget of \$931,670,400.

The plan, for fiscal 1962, covers funds for 156 continuing construction projects, 27 new construction starts, and five reimbursements to local interests for construction work already completed. Funds also are requested for 49 continuing planning projects, 24 new planning starts, and five projects "deferred for restudy."

The new planning starts are: Arkansas River and Tributaries, navigation locks and dams, Arkansas and Oklahoma; Ouachita River 9-ft Project, Arkansas and Louisiana; Los Angeles-Long Beach Harbors, California; Walnut Creek, California; Colebrook River Reservoir, Connecticut; West Thompson Reservoir, Connecticut; Miami Harbor, Florida; Henderson County Drainage District No. 2, Illinois; Sny Island Levee Drainage Project, Illinois; Uniontown Lock and Dam, Indiana and Kentucky; Des Moines, Iowa; Lawrence, Kansas; Corbin, Kentucky; Laurel River Reservoir, Kentucky; Chicopee Falls, Massachusetts; Tombigbee River and Tributaries, Alabama and Mississippi; Lackawanna, New York; Blanchard Reservoir, Pennsylvania; Lower Woonsocket, Rhode Island; Big Fossil Creek, Texas; Blieders Creek Reservoir, New Braunfels, Texas; Little Dell Reservoir, Utah; Lower Granite Lock and Dam, Washington; and Port Townsend, Washington.



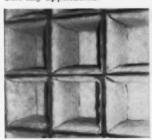
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Union Carbide research has produced the truly ideal strong, high-capacity filter medium with an irregular, highly-arresting cross section—DYNEL® modacrylic fiber! No other filter medium can touch it for stopping and holding unusually large quantities of dust and foreign matter. This dry, un-oiled filter can be vacuum cleaned several times to extend service life even further, if desired. Proved in scores of major installations—in both new and modified systems—ULOK Air Filters are available in a variety of forms to suit any application.

#### The Remarkable ULOK Cube-Type Air Filter

Shaped like an open-top box with slightly tapered sides, the Ulok Cube-Type Air Filter with five filtering surfaces represents the most efficient filter shape yet perfected. In operation, air flow first carries the dirt particles to the back face of the filter. As dirt collects on the back face, and air resistance increases, air flow is shunted to the four sides, assuring uninterrupted filtration. In addition, the Ulok Cube-Type Air Filter provides far greater filtering surface than conventional filters with equivalent face dimensions ... and the unique design of the wire basket-type retainers and batt edge assures a tight, leak-proof, press fit.



Front (Dirty Air Side) View of Typical Bank



Rear (Clean Air Side) View of Typical Bank

Advantages: • Up to 600% longer service life over other throw-away filters due to higher dust-holding capacity • 22% to 28% National Bureau of Standards atmospheric discoloration efficiency • Easier installation—filter is light in weight; no sharp edges or "splinters" to hurt hands • Lower labor and maintenance costs; lower inventories because fewer changes are required • Easier disposal—simply collapse and discard—leaving dirt in the bag • 14 different sizes suitable for all new, and many existing installations • Only \$7 to \$13 per 1000 CFM of air covers total costs (except labor).



#### **ULOK Panel-Type Air Filters**

Patented method of media formation provides a low-density, three-dimensional batt of high capacity DYNEL modacrylic fiber. Entire face and depth of filter traps dirt particles as inherent strength of medium permits elimination of face supports. Modern ring support provides sure-seal edge and eliminates problem of filter by-pass. Particularly suitable for slide-in applications, and all flat or V-bank installations not adaptable to the Cube-Type Filter. Available in 1" and 2" thicknesses, in 9 different sizes, from 10" x 20" to 24" x 24".

For special applications: ULOK filter media is also available in 2" Pads,  $58'' \times 60'' \dots$  in  $\frac{1}{2}$ " Rolls,  $58'' \times 25$  yards . . . and in 1" Rolls,  $58'' \times 15$  yards.

For complete information on ULOK Air Filters, including efficiency and pressure-drop charts, write for new bulletins.

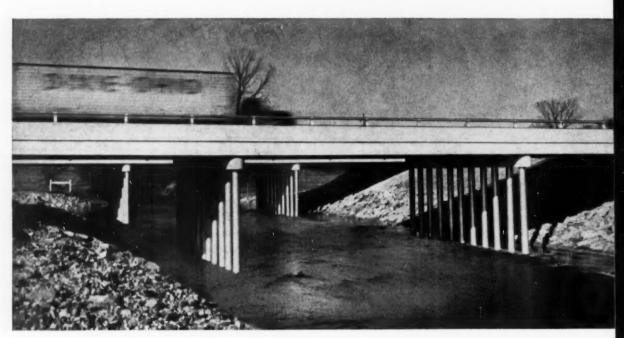
UNION CARBIDE

#### UNION CARBIDE DEVELOPMENT COMPANY

Division of Union Carbide Corporation 270 Park Avenue, New York 17, N. Y.

ULOK, DYNEL, and UNION CARBIDE are registered trade marks of Union Carbide Corporation

## Why Armco Pipe Piling



1.



3



4

- 1. Twin bridges on exposed Armco Pile bents carry Interstate 71 over Clear Fork Creek in Ohio.
- 2. Armco Piling is driven for foundation of bridge abutment on Cleveland Innerbelt part of Interstate 90 in Ohio.
- Here are 60-foot lengths of Armco Piling at site of foundation for approach work of new Woodrow Wilson Bridge at Alexandria, Virginia. Interstate 495.
- Interstate 10 construction at Lake Charles, Louisiana, features foundation of Armco HEL-Cor® Pile Shells.
- Bridge abutment on Interstate 5W in California will rest on Armco Pipe Piling foundation. Note batter piles.

## and Pile Shell Get the Important Jobs on the Interstate System



Interstate Highway construction, with its controlled access requirements, puts the spotlight on bridges. To handle the tremendous job of foundations for the hundreds of bridge piers and abutments, highway builders are relying more and more on the Armco family of foundation products. Why? They have been proved in service. Engineers and contractors know what they will do from past performance.

Armco Pile Shell is a lightweight, helically corrugated shell. It is supplied in specified lengths—any lengths up to 64 feet. It is well known for its uniform roundness that makes splicing easy. Salvage of short cut-offs is practical.

Armco Steel Pipe Piling is available in specified lengths up to 90 feet. By specifying lengths, you reduce field splicing to a minimum. Handling is simplified, driving goes fast. Armco Piling is made to ASTM Specification A 252-59, and it is delivered with a mill certificate to prove it. This mill certificate assures the exclusion of sub-standard pipe from your projects.

You can get Armco Pile Shell in 16 different diameter-wall thickness combinations; Pipe Piling in 132 diameter-wall thickness combinations. Thus you can specify *exactly* the foundation pipe you need, without compromise.

Use the coupon to send for a 16-page catalog on Armco Foundation Products. It provides the specifications and dimensional data you need. In addition, an authoritative, 105-page book, "Pipe Piling for Bridges and Buildings" is available through the Armco Sales Engineer in your area. Check the coupon to reserve your free copy. Armco Drainage & Metal Products, Inc., Subsidiary of Armco Steel Corporation 5881 Curtis Street, Middletown, Ohio.

	Metal Products, Inc., t, Middletown, Ohio	born at Armco
Send me the 16-	page catalog on Armco Foundation Prod	lucts.
Ask Armco Sales for Bridges and E	s Engineer to bring me comprehensive, Buildings."	105-page book, "Pipe Piling
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STREET		
CITY	ZONE	STATE
TELEPHONE NUMBER		************

ARMO

ARMCO Drainage & Metal Products



## SPIROVORTEX SYSTEM FOR CHECOTAH, OKLA.

Another new development in Activated Sludge Treatment

The sewage treatment plant shown above was placed in operation last year to serve a population of 3,500 in a recreational and agricultural area. It utilizes the Dorr-Oliver SpiroVortex System, providing B.O.D. removal in excess of 90% with low overall operating costs, simple control and capability for effective handling of widely varying loads.

Units comprise a 30' dia. Dorr Clarigester, two 24' dia. Spiro-Vortex tanks providing rapid and thorough mixing by a spiraling action, one 26' dia. Superate Filter giving highly efficient aeration and filtering, and a 24' dia. Dorr Final Clarifier.

For information on the operation of the SpiroVortex System, write for Bulletin 7314 to Dorr-Oliver Incorporated, Stamford, Connecticut.

Consulting Engineers: Collins & Flood, McAlester, Okla. and Ardmore, Okla. General Contractor: Bell Construction Company, Okmulgee, Okla.

Clarigester, SpiroVortex, Superate T.M. Reg. U.S. Pat. Off.



## The New Projects

#### Submarine Drydock

A new graving dock facility, 750-ft long and 140-ft wide with steel caisson gate, is being installed at the Charleston, South Carolina Naval shipyard. The surrounding area also will be improved with new roads, railroad trackage, crane trackage, portal cranes, winches, and operational equipment.

Designed by Frederic R. Harris, Inc. and Louis Y. Dawson, consulting engineering firms who also did preliminary engineering studies, the dock construction will take two to three years to complete. The facility will accommodate one large cruiser or several smaller vessels such as atomic fueled submarines.

In addition to the complete service galleries and utility tunnels, there is a flooding and dewatering system capable of handling 10 million gallons of



water per hour. Another feature is the provision for raising water levels in the dock to 2½ feet above mean tide level, permitting deep draft ships and those with below keel gear to clear the keel blocks.

#### Manufacturing and Office Facility

The fifth and largest plant for Haloid Xerox, Inc., designed and under construction by The Austin Company, is scheduled for occupancy in early 1962. The 315,000-sq ft manufacturing area is framed in 60-ft bays extending the full 560-ft length of the plant proper. Included in the project are a 10,000-



## MURCO GATE HOISTS \*

#### DESIGNED TO MEET YOUR REQUIREMENTS

MURCO Gate Hoists are designed from knowledge and experience... backed by over 75 years in design and manufacture... with hundreds of successful installations made for leading engineers, power companies, industrial plants, government power projects... each MURCO Gate Hoist designed to do its job, incorporated into its design the factors that meet the requirements of the operators.

MURCO Gate Hoists are designed and made for any size power dam... capacities from less than 1 ton to over 375 tons... from the smallest hand operated to the largest motor operated gate hoist, all made to specifications.







One of the two 380-ton MURCO Gate Hoists furnished to the Power Authority of the State of New York. Each hoist operates a gate 46' wide by 67' high at one foot per minute. These gates divert the water from the Niagara River above the Falls into covered conduits five miles long. The two conduits bring the water to the Niagara Generating Plant on the United States side of the Falls.

...........

Level at Long Sault Dam, St. Lawrence Power Project ... illustrated is one of the 18 MURCO Gate Hoists installed in this project.



For the second largest hydroelectric power plant in the United States at Massena, New York — as part of the St. Lawrence power project — Uhl, Hall & Rich, project engineers, selected MURCO Gate Hoists. Each hoist weighs 93,000 lbs. . . . overall length 57 feet, 8½ feet wide, 12½ feet high . . lifting capacity of 175 tons and will raise and lower the gates in a dam at a speed of 1 foot per minute.

D. J. MURRAY MANUFACTURING CO.
MANUFACTURERS SINCE 1883
WAUSAU-WISCONSIN

sq ft, one-story cafeteria, first aid and industrial relations offices, and a 30,000-sq ft, two-story office building. These air conditioned buildings will be enclosed by an aluminum curtain wall frame with precast concrete filler panels.

#### **Unusual Floor Ventilation**

An infinite access floor, composed of 18-in. square aluminum blocks supported on adjustable spacers, has been designed to permit power cables and IBM equipment to be located anywhere in a room. Reported to be the first such floor system, it was designed by Nance Engineering, Inc., Omaha, Nebraska, for the computer facilities of the Woodmen of the World Life Insurance Society, located in the Insurance Building, Omaha.

Since a 70 F temperature and a 50 percent humidity must be maintained constantly for efficient IBM



Block flooring provides infinite access for installations.

operation, the excess heat from the machines is removed via grilles in the bottom of the equipment — then through the space between the structural floor and the raised floor.

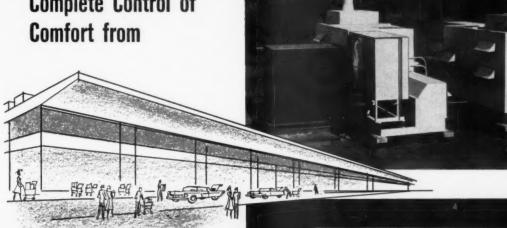
#### Vancouver Sewage Plant

The Iona Island sewage plant, which will serve Vancouver City, the University Endowment Lands, and western Barnaby, is expected to be able to handle a peak flow of 340 million gallons per day when fully expanded. This project, developed jointly by the consulting engineering firms of Brown and Caldwell, San Francisco, and Crippen Wright Engineering, Ltd., will cost about \$11 million. Project planning took 30 months, and required 599 drawings and a 250-page specification.

The first stage, under construction by Perini Pacific Ltd., will serve 320,000 people and will cost over \$4.5 million. Operation of the plant will begin with the inflow of raw sewage from three, 66-in. concrete siphons constructed beneath the North Arm of the Fraser River. The sewage is prechlorinated, ground and screened, run through grit chambers, pre-aerat-

NOW...

**Complete Control of Comfort from** 



## WITHIN THE CONDITIONED AREA with



### ROOF MOUNTED AIR CONDITIONERS by DUNHAM-BUSH

Dunham-Bush 'RMC' roof mounted conditioners, developed to meet the ever increasing need to save floor space in conditioned areas, are now available with a central control

station which permits "direct dialing" comfort control from within the conditioned area. Panel control provides for easy heating or cooling adjustment and automatic push button reset ... prevents tampering ... saves time ... reduces maintenance. Pilot lights provide complete visual indication of system's operation: indicator light advises when filter needs replacing.

Central control station can be used to govern operation of several units serving a single zone, or to control a single unit serving several zones.

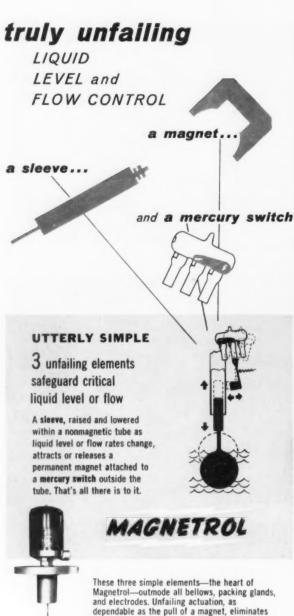
'RMC' units are available in 5,  $7\frac{1}{2}$ ,  $1\overline{0}$  and  $12\frac{1}{2}$  ton models and are easily installed atop any single story building. Heating or cooling is immediate at the flick of a switch. Air cooled, 'RMC' units require no plumbing or piping connections, are furnished completely factory wired, with all interior plumbing assembled. Units can be furnished for use with remote diffuser applications.

It will pay you to investigate this modern, economical air conditioning-heating system. Form No. 6023A, free on request, contains complete details.

DUNHAM/BUSH

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and electrodes. Unfailing actuation, as dependable as the pull of a magnet, eliminates all wearing parts and maintenance; nothing to go wrong.

Magnetrols operate indefinitely to protect the critical level or flow of almost any liquid, at virtually any temperature or pressure. They are so simple that a change in material is usually all that is needed to adapt standard units to any specific application. "Special" Magnetrols are rare.

Magnetrols are available for controlling liquid level changes from 1/4" to 150' and more with single or multi-stage switching; flow switches to signal start, stop or insufficient flow within fractions of gpm rates.

Fill in coupon and attach to your letterhead for full information.

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Please send	d me catalog data	and fu	I information	on Magnetrol
Liquid	Level Controls		Flow Contro	Is
Name				

ed, and then placed in sedimentation tanks. Gas from the digesting operation aids in mixing raw and digested sludge, and serves as fuel for six enginegenerators, which also can operate on diesel fuel.

When complete, the plant will be nearly selfsufficient. It is estimated that only 18 men on a 24hour basis will be needed to operate the plant.

#### American Cement Corporation Building

The 13-story American Cement Corporation building, Los Angeles, California, combines sculptural and structural concrete in precast form, and more conventional cast-in-place concrete elements. Designed



New American Cement Corp. building in Los Angeles.

by Daniel, Mann, Johnson & Mendenhall, the building has a nine-story office tower, superimposed on a base section containing parking facilities, mechanical rooms, and utilities.

The "X" forms of the tower are inclined columns which bear the exterior floor slab loads. A center "T" core of cast-in-place, reinforced concrete takes interior floor loads and also contains the elevator banks, utility services, and mechanical equipment.

When completed, the tower portion will be column-free with fixed glass curtain wall recessed behind the structural "X" grill. In addition to the esthetic considerations, this structure is designed to conform to area seismic stress requirements. Contractor for the project is Peter Kiewit Sons.

#### 630-ft Concrete Stack

The Rust Engineering Company will construct a 630-ft reinforced concrete chimney to replace two.



### Specify the drainline that defies corrosion... PYREX\* DRAINLINE

If your client pours corrosives down the drain, give him the dependability and durability he needs by specifying PYREX "double-tough" drainline.

Pyrex drainline wasn't born yesterday. It's been handling the toughest, meanest wastes for over two decades. Many of the earliest installations are still in service today. Here's why: It's resistant to more acids and acidic compounds than any other material.

PYREX drainline also drastically reduces maintenance. It neither corrodes nor leaks, so maintenance costs shrivel to almost nothing. Dangerous hidden problems that corrosive chemicals produce in metallic piping are eliminated. Plug-ups can be seen before complications set in.

PYREX drainline is easy to Install. Simple stab-fit, one-bolt coupling . . . light weight . . . fewer hangers, fewer joints . . . no cleanouts or expansion joints-all spell significant savings in installation cost.

There's a lot more, including specs, in Bulletin PE-30. Write for a copy to Plant Equipment Department, 2406 Crystal Street, Corning, N. Y.

see our catalog in Sweet's





CORNING GLASS WORKS

## For good workability at low slumps . . . use



SYMENTARD

Whenever job requirements call for concrete mixes that have to have good workability at low slumps—use Horn's Symentard—the concrete retarding densifier.

Since Symentard works by slowing down the rate of hydration, and not by entraining air, the proportions can be varied to meet job and climatic conditions. This means stronger, denser concrete that will have higher resistance to cracking.

For complete details and technical data, call or write:



#### A. C. Horn Companies

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Plants in Long Island City • Chicago • Houston • Los Angeles • San Francisco • Portland, Ore, • Toronto • Morth Bergen, N. J. • Sales Offices and Warehouses throughout the United States and Canada.



600 Rooms with bath from \$6.00

NO CHARGE FOR CHILDREN FREE RADIO AND TV AIR-CONDITIONED ROOMS

Delicious Cuisine and Beverages

- WAIKIKI ROOM
- JOLLY MILLER
- COFFEE SHOP



FEderal 3-3177 Thomas P. Ryan, mgr. 200-ft chimneys now serving the Pennsylvania Electric Company, Johnstown, Pennsylvania. The 6500-ton stack will range from 36-in. wall thickness, 37'-6" outside diameter at the base, to 8-in. thick, 19'-2" diameter at the top. A steel liner in the top 421 feet of the stack will extend 16 feet above the concrete.

Consulting engineers are Gilbert Associates, Inc., Reading, Pennsylvania, and Jackson and Moreland, Boston, Massachusetts.

#### \$20 Million Shopping Center

Welton Becket and Associates, architects and engineers, announces that the Grossmont Shopping City, occupying 110 acres near La Mesa, California, is under construction. This shopping center will provide some 604,000 sq ft of shopping area which can be expanded to 800,000 sq ft. Buildings will be primarily of reinforced concrete and will feature unusual masonry, ceramic tile, and anodized aluminum treatments. Open areas within the center will contain multivaulted thin shell concrete pagodas, reflecting pools, and sprays. Del E. Webb is the contractor.

#### Materials Handling in Smelter

A new materials handling system for the Kennecott Copper Corporation plant, Garfield, Utah, designed to handle concentrates, lime sands, silica fluxes, precipitates, and other secondary materials, is presently under construction by The Rust Engineering Company, of Pittsburgh, Pennsylvania. Designed to eliminate the existing roasting process, the new system will save time in converting mill concentrates into copper anodes.

This contract is the first step in a planned rehabilitation of the entire smelter which was purchased by Kennecott in early 1959. Much of the present system of production has been in operation since its construction in 1906.

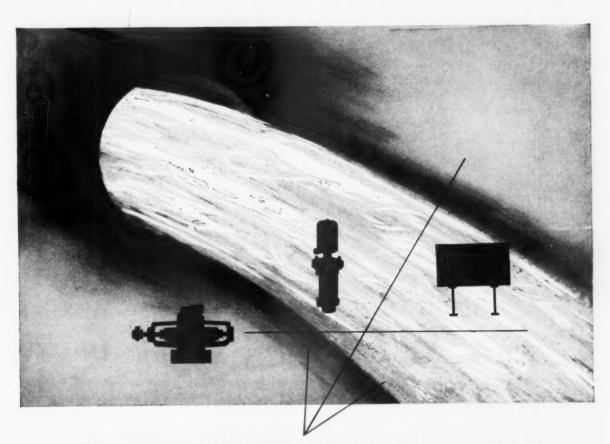
#### Lenkurt Expands

The John S. Bolles firm of architects and engineers has been selected to design the new Lenkurt Electric Company, Inc. development engineering offices, a laboratory, and cafeteria, in San Carlos, California. The \$2 million expansion program will add 112,000 sq ft in a two-story engineering laboratory and 8000 sq ft in cafeteria space.

The laboratory will feature steel frame construction with tilt-up concrete walls, and steel deck for both second floor and roof. Space flexibility will be accomplished by movable partitions and demountable ceiling structure.

#### Vietnam Mining Development

Mining specialists from Paul Weir Company, Inc., Chicago consulting engineering firm, have arrived in South Vietnam to assist the native government in



#### How you can feed a boiler better - and save money, too

At Schaub we don't make boilers—we just make them work better, at lower operating cost, through better care, feeding and returns handling. This is our sole job—engineering and manufacturing condensate handling, deaerating and boiler feeding systems for any degree of automation you require.

#### SEE SCHAUB FIRST

SPECIALISTS IN AUTOMATIC BOILER FEED AND CONDENSATE HANDLING SYSTEMS...

boiler return systems • deaerating systems • "'pree-heet" systems • transfer and boiler feed pumps • heat reclaim systems • console blow-down recovery systems • cendensate return units • power plant specialties

MANY OTHERS IN TYPES AND CAPACITIES TO MEET YOUR NEEDS MOST EXACTLY AND ECONOMICALLY

#### One source of responsibility

Because we specialize and concentrate on what we can do best, you work with just one responsible source. We supply the complete feed and condensate handling package and underwrite its continuous, economical performance. All components are phasedout to work together—guaranteed individually and as a complete system to meet the specifications you set.

#### Individual units, too

Of course, we'll provide individual "pieces" to fit and improve an existing condensate handling and boiler feed system . . . from pumps to console blow-down systems. Again, you get the same guarantee and responsibility.

In sum, you tell us what you need—in exact requirements or broad objectives. Then your problem becomes ours—from planning, through design, installation and service. Hundreds of Schaub owners and engineers will tell you it's the safest, most trouble-free way to meet any boiler feed or condensate handling need.

Factory trained representatives coast-to-coast! Specialists to advise, supervise installation and instruct in most efficient operation.



#### FRED H. SCHAUB ENGINEERING COMPANY

5303 Belmont Road, Downers Grove, Illinois

Please send my copy of technical data and Catalog No. 55-D.

NAME

Clip and attach to your letterhead.



#### COMPLETE LINE OF SAMPLING AND SAMPLE PROCESSING EQUIPMENT

Wet, dry and dust-tight units. Simple, reliable, automatic. Units with cutter travel to 10' and longer. New bottom-dump dry cutters (patent pending) for use where headroom is 10" or less.

Dimensioned layout drawings and specifications sent on request.

#### NEW ... 30"/sec. Cutter Speed

reduces bulk of material taken — often eliminates cost of secondary sampling—without affecting reliability of sample.



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## DOW GREENHECK

#### **Aluminum Roof Exhausters**

"C" SERIES DIRECT DRIVE CENTRI-FUGAL SPUN ALUMINUM EXHAUSTER



A roof exhauster that has its motor out of the air stream and the unit cradled on resilient mounts . . . high efficiency wheel design with overlapping inlet cone providing exhausting capacities . . . available in sizes from seven to eighteen inches.

#### LOW SILHOUETTE CENTRIFUGAL BELTED POWER ROOF EXHAUSTER

Motor and Drive are completely isolated from the air stream in this new Greenheck LB-Line...



enclosed in a one piece Spun Aluminum Housing . . . Symmetrical shape lends eye appeal to any installation. Available in a size range from 16" to 48".

Write for latest catalog, complete details and specifications.

GREENHECK FAN & VENTILATOR CORP.

the development of the Nong Son coal mines. Harold Price, anthracite consultant, leads the party, and Dr. Stewart Ross, Charles Tudor, and Patrick Wood are team members.

#### Indian Refinery Project

According to the Commerce Department Bureau of Foreign Affairs, India is selecting a firm of engineers to consult technically on the construction of a turnkey oil fractionalization plant. According to the report, the consultant will: prepare detailed design, specifications, and drawings; provide over-all supervision, including construction and machinery installation; and arrange for distribution of butane, propane, and other products to users. The plant is reported to have a design capacity to fractionalize 38 million cubic feet of gases from the Assam oil fields for agricultural, utility, and industrial uses.

#### Urban Renewal

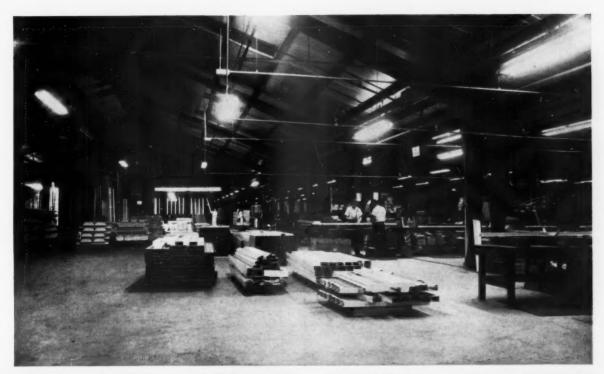
The City of Santa Monica Redevelopment Agency is considering a plan to raze 36 acres of old, dilapidated structures on the ocean front and replace them with a \$50 million planned residential, commercial, and civic center.

The project involves redevelopment of an eightblock strip along the coast into four distinct neigh-



New \$50 million development planned for Santa Monica.

borhoods, containing a total of 2000 dwellings. The residential building design involves the construction of four, 21-story buildings and four, 13-story struc-







Light & Power Utilities' new 112,000-sq.-ft. quarters in quality Stran-Steel were built under Mississippi's "Balance Agriculture with Industry" Program. Architects: Lee, Brumfield and Riggens, Jackson, Miss.: Stran-Steel Contractor: Dixie Metal Buildings Co., Memphis.

## Quality that lowers costs every day of the year

Working to fixed costs on tight budgets? Then see how Light & Power Utilities Corporation got space, style and savings in their new Stran-Steel plant in Olive Branch, Mississippi! This lighting equipment manufacturer chose Stran-Steel to get maximum clear floor space to house bulky painting and metal-working facilities and plenty of leeway for future expansion, too. Yet Light & Power's Stran-Steel structure cost them only \$2.23 per square foot. It was erected in just 100 working days—about half the time conventional construction requires! Stran-Satin walls and roof panels, color-coated at the factory, saved \$12,000 in painting costs. Complete insulation, so easily and economically

installed in any Stran-Steel structure, cut gas heater requirements by 40%, lowering costs an additional \$10,000. And the owners will save \$5,000 every year in heating, as much as 15% in air conditioning costs! Your local Stran-Steel dealer will be

happy to show you how you can have quality and lower costs, too. He's listed in the Yellow Pages under STEEL BUILDINGS or BUILDINGS, STEEL. Or mail the handy coupon below.



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	Name	Title
Stran-Steel Buildings in Stran- Satin Color, I'm interested in a	Company	Phone
building approximately	Address	County
ft. byft. to be used for	City	ZoneState

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### Client blowing his stack...?





#### then specify A. O. Smith glass-lined smokestacks-

Build client satisfaction with a smokestack that:

• Lasts 3 to 5 times longer than unlined steel stacks

• Installs easily with no need for special equipment or highly skilled workmen

• Is lightweight - lower foundation costs

• Requires little maintenance glass can't rust

• Is now available in colors For full facts, write Dept. CE-61.



PROCESS EQUIPMENT DIVISION P. O. BOX 584 . MILWAUKEE 1, WISCONSIN tures. A park common to the four areas will feature a flower shaped, 200-seat restaurant. The areas will have a common shopping center, a bank, a 6-story general office, a motel, and a parking structure in commercially zoned sections.

#### **New Power Station**

Reported to be the largest lignite fueled steam generating plant in the U.S., the Otter Tail Power Company's 53,500-kw Hoot Lake station has been in service for nearly a year. The \$11.5 million station is operating at a level equal to its design rate, despite high moisture content, ranging from 30 to 35 percent, and the low quality of lignite fuel. The suc-



Otter Tail Power Company's Hoot Lake generating plant.

cess is attributed in part to the Hagan automatic

control systems installed in the plant.

The boiler - a tangentially fired, 400,000 lb per hr, 1450 psig, 1000 F Combustion Engineering unit with reheat to 1000 F - is reported to be the first and largest pulverized lignite fired reheat system in the northern Midwest. Otter Tail serves a 70,000square mile area, and this plant's 53,500-kw turbinegenerator combination brings the company's total power output up to 185,405 kw. The consulting engineer for the project was Burns and Roe.

#### Elizabeth River Tunnel

Some of the largest prefabricated tunnel sections ever made are being used in a new vehicular tunnel under the Elizabeth River, between Norfolk and

## Rubber PIPE GASKETS

#### ... provide visual proof of correct pipe coupling

Hamilton Kent Type TYLOX Gaskets for concrete sewer pipe provide watertight joints at head pressures up to 50 feet. Gasket consists of base, multiple sealing fins and inspection flange which



TYLOX "C" Gasket under full compression. Note the visual inspection feature.

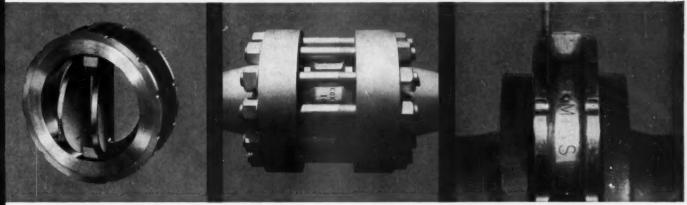
overhangs the edge of the pipe tongue, or alternately, the tongue offset, according to the type of pipe.

"C" Gaskets are of true compression type, made of either rubber or neoprene. They may be installed at the job site, or pre-assembled at the pipe manufacturer's plant. Compounded specially to resist sewerage and industrial waste acids, they never deteriorate. Under ground and under compression, TYLOX "C" Gaskets outlast the pipe itself. Write for brochure.

#### HAMILTON KENT MANUFACTURING CO.

KENT, OHIO . ORchard 3-9555 CANADIAN: 3194 Mayis Rd., Cooksyille, Ontario

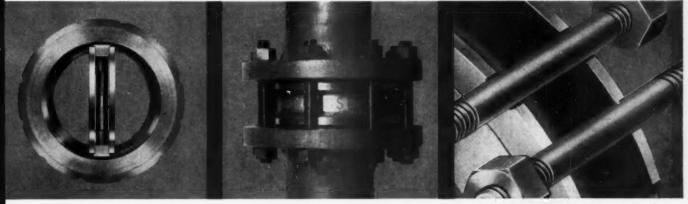
#### COSTS LESS-WEIGHS LESS-EASY TO INSTALL



Because of its sound, imaginative design, the Duo-Chek check valve is smaller, uses less material, and costs less to buy. It costs less to maintain and lasts longer, too.

A Duo-Chek check valve weighs on the average less than ten per cent, with some models weighing only two per cent, as much as conventional check valves for the same service. No foundations are needed. The Duo-Chek fits between the flanges, is smaller and weighs less. For example, a 6-inch steel valve, series 300, weighs 29 lbs., requires no special installation equipment:

#### NO SLAM - ANY POSITION - CUTS INVENTORY



A stainless steel coil spring effects positive sealing action. The quick action of the spring closes the valve before reverse flow can occur. Result: No slam, no water hammer.

The Duo-Chek simplifies piping arrangements. The spring loaded plates operate in any position. Most popular sizes can be installed even in vertical lines with downward flow.

The unique versatility of the Duo-Chek greatly reduces inventory. In sizes 2 through 12 inch, one valve fits both series 150 and 300 flanges; 2- and 3-inch sizes fit series 600. too.

### MISSION DUO-CHEK CHECK VALVE

The Mission Duo-Chek® check valve performs all regular check valve duties, yet is smaller, lighter, and easier to install. Duo-Chek check valves are available in a complete range of sizes from 2 to 48 inches, ASA Series 125 through 2500. They come in various end connections, such as raised face, ring joint, weld neck, etc. They are made in carbon steel, stainless steel, aluminum, and bronze. Special alloys are available. Because of the small size of the Duo-Chek, special alloy valves cost much less than conventional valves in the same alloy.

Sealing material is bonded in a groove in the plate. The sealing material makes an O-ring seal, which pressure deforms until metal-to-metal contact is made by the plate and body seat. Sealing material may be Buna-N, Teflon, Viton, or metal, depending on the service.

The simplicity of design of the Duo-Chek pays off in every installation with longer life and less maintenance. Only six parts are contained within the body of the Duo-Chek, held without the use of internal fasteners or joints of any kind. All parts are interchangeable.

The Duo-Chek is much lighter in weight than conventional check valves, yet is stronger. By dividing the opening, the unsupported plate area is reduced so that each plate requires only one-eighth of the weight of a conventional clapper of the same strength. The short stocky body is inherently stronger and more rigid than a check the strength of the stronger and more rigid than a

short length of heavy wall pipe.
Whatever your check valve application, the Mission Duo-Chek can cut initial purchase and installation costs, cut maintenance costs from then on. Contact Mission now for a representative.

MISSION VALVE AND PUMP CO. A SUBSIDIARY OF MISSION MANUFACTURING CO. P. O. Box 4209, Houston, Texas • Cable Address 'MISSCO' • Export Office: 30 Rockefeller Plaza, New York • In the United Kingdom: MISSION MANUFACTURING CO., LTD., 1 Hanover Square, London W. 1 England • Cable Address 'MISSOMAN' • Sold by Mission Manufacturing Company outside of Canada and the U.S.A.

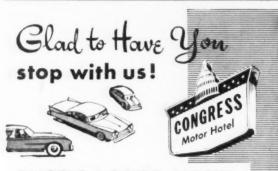




— with none of the hazards, delays and uncertainties of measuring by stick or tape. Shows weight, volume or depth of liquid in *any* storage or processing vessel — on the spot or hundreds of feet away. Guards against errors, shortages, losses. Proven through 33 years' use, in every industry. *Local service* provided.

CATALOG 1010 gives details; shows many applications. May we send you a copy?





#### RUSTIC LODGE MOTEL

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Tree!

Write for literature and new TRAVEL GUIDE listing fine motels from coast to coast, inspected and approved by Congress of Motor Hotels.



Portsmouth, Virginia. The new tunnel, the second built for the Elizabeth River Tunnel Commission, will be 3462-ft long.

Twelve, 300-ft sections are being fabricated on shore and floated to position in the river. The sections, weighing about 600 tons apiece, are 5/16-in. steel, lined with 18 inches of reinforced concrete. Inside diameter of the tube is 33 feet.

Consulting engineer for the project is Parsons, Brinckerhoff, Quade and Douglas, of New York. The general contractor is the Diamond Construction Company, of Savannah, Georgia.

#### New View of the Falls

Niagara Falls, already famous for its tourist attractions, will get a new one, taller than all the rest, late this summer. International Resort Facilities Limited, which last year pioneered the sale of imported duty-free merchandise to American tourists in the Thousand Islands area, is building a 300-ft observation tower as part of a second duty-free center at Niagara Falls.

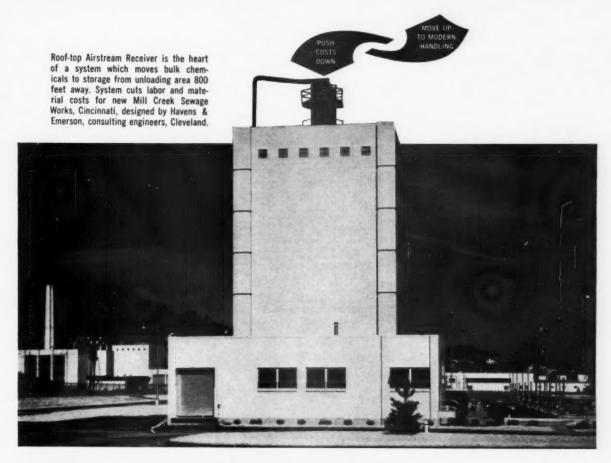
The tower will provide a panoramic view of the entire Niagara Frontier region, and the merchandise center will offer foreign goods substantially below



Niagara Falls observation tower, part of duty-free center.

regular import cost. The two structures will be separated by a series of pools and fountains, with colored lights at night to complement the illumination of the Falls.

The tower and merchandise center were designed by the Chicago architectural firm of Floyd H. Magnuson and Associates, Consulting engineer is J. Fruchtbaum, of Buffalo.



designing a water or waste treatment plant?

## consider the savings possible with air conveying of dry chemicals

If you have had experience with an Airstream Conveyor for dry chemicals, you know the savings it provides to a water or waste treatment plant.

Some of you may be unaware of how an Airstream Conveyor can save money. First, it permits a minimum of 16% savings in material costs through bulk purchasing. Next, it eliminates all but one man from the handling operation-and depending upon how many carloads a month the plant buys, this man may be only part-time. Further, one system will do the complete handling job no matter how many different dry chem-

icals the plant receives. Finally, it provides streamlined, efficient plant operation with no spillage and waste, no dust in the plant and no balky mechanical equipment with large maintenance bills.

Perhaps you have never specified a Dracco Airstream Conveyor. We believe you owe it to your clients to consider using this modern handling method in your next design. A Dracco engineer will be glad to give you more details. Call or write Dracco Division of Fuller Company, Harvard Avenue and East 116th Street, Cleveland 5, Ohio.



Write today for your Dracco ready reference file. Contains complete guide specs for pneumatic conveyors in water and waste treatment plants.

I R F F G airstream conveyors dust control equipment





Day-Brite PARAFLO® Troffers with patented PARALOUVERS® simplify ceiling appearance and planning by eliminating the need for separate air diffusers . . . deliver 100 footcandles with a minimum of glare. PARAFLO Patent Nos. 2,845,854 · 2,845,855 · 572,565 · 575,897 PARALOUVER Patent Nos. 26,833,799 · 507,541

Sleek fixture appearance complements modern wall treatment throughout building.



Pure Oil Company Building, Palatine, Illinois Architect: Perkins & Will; Electrical Contractor: Kelso - Burnett Electric Consulting Engineer: E. R. Gritschke & Associates, Inc.



## Who goofed and forgot the air diffusers?

Nobody goofed.

In fact, very *special* attention was given to assure Pure Oil Co. employees the finest in year 'round comfort. Day-Brite combination lighting-air diffusing fixtures deliver lighting, cooling, heating and ventilation — all through the same outlet.

The result is an attractive, efficient working environment with...

High-level, low-glare Day-Brite lighting for better vision;

More uniform air distribution, thanks to the many diffusing sources;

And clean, uncluttered ceiling appearance.

A full year was spent pre-testing these

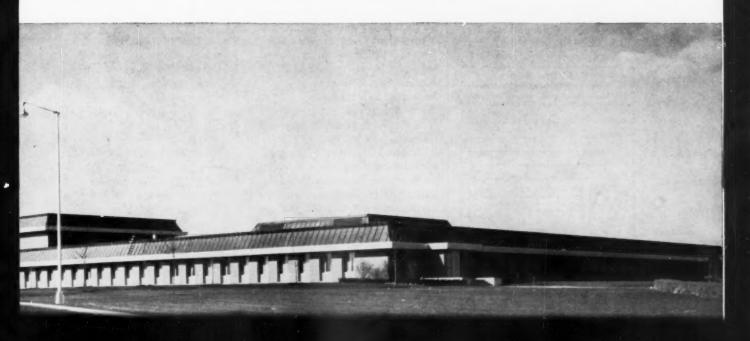
Day-Brite fixtures from every possible angle, including ease of installation and maintenance. Now in operation, Pure Oil Co. engineers report "complete satisfaction!"

For more information on how Day-Brite combination lighting-air diffusing fixtures can simplify your next ceiling plan, contact your Day-Brite representative listed in the Yellow Pages or write Day-Brite Lighting, Inc., 6260 N. Broadway, St. Louis, Mo., and Santa Clara, Calif. In Canada: Amalgamated Electric Corp., Ltd., Toronto 6, Ont.

Write for FREE booklet on Comfort Conditioning with Light and Air: Day-Brite Lighting, Inc., 6260 N. Broadway, St. Louis 15, Mo.



NATION'S LARGEST MANUFACTURER OF COMMERCIAL AND INDUSTRIAL LIGHTING EQUIPMENT



#### "MARKETS UNLIMITED" \*

## \*\*WE ELIMINATED \$3800.00 IN 3-PHASE WIRING with the

### add-A-Phase

Says RUSS JONES
RUSS JONES CONSTRUCTION CO.
ST. LOUIS BUILDER

"The ADD-A-PHASE enabled us to operate this 3-phase equipped

SANITARY SEWAGE DISPOSAL PLANT FROM SINGLE PHASE LINES"



Power Converter is successfully operating the following 3-phase equipment from single phase lines

- 2 H. P. BLOWER
- . 1 H. P. AGITATOR DRIVE
- 1/3 H. P. SUMP PUMP

Add-A-Phase units are available for 1 H.P. to 50 H.P. three-phase motors ... write for more information.

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## Men and Firms

Murray A. Wilson, a consulting engineer of Salina, Kansas, has been elected president of the National Society of Professional Engineers. Wilson has served as president of the Kansas Engineering Society and the Kansas Section of the American Society of Civil Engineers, and has also been a member of the ECPD Engineering College Accrediting Committee for Region V, the Kansas State College Research Foundation, and the Governor's Advisory Committee on Flood Control. He is a member of the American Institute of Consulting Engineers, American Water Works Association, American Public Works Association, and American Road Builder's Association.

Three of the area vice presidents elected for the administrative year which begins in July also are consulting engineers.

Harvey F. Pierce, vice president for the Southeastern area, is a member of the firm of Maurice H. Connell & Associates, Inc., and a partner in Connell, Pierce, Garland and Friedman, architects and engineers. A past president of the Florida Engineering Society, he has served as a national director of the National Society, and currently is chairman of its Membership Committee.

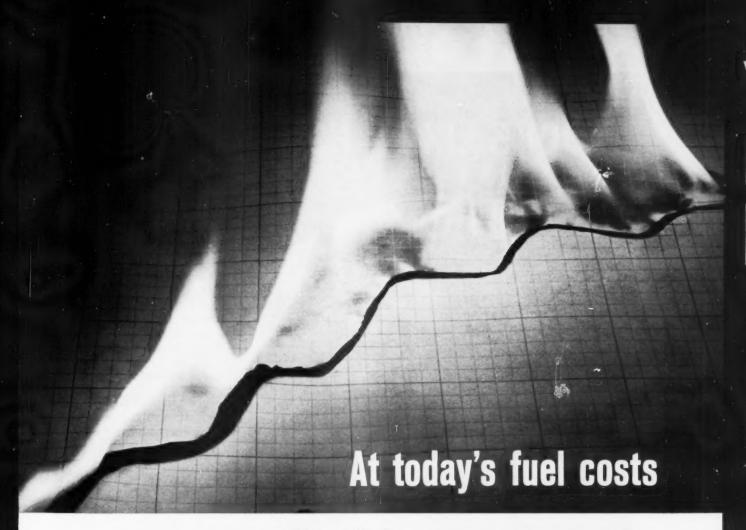
Thomas T. Mann, vice president for a second term from the Southwestern area, heads the Mann Engineering Company, in Roswell. He has served with the New Mexico State Highway Department, New Mexico Highway Contractors, and as city engineer for Roswell.

¶ John H. Stufflebean, vice president for a second term from the Western area, is chief engineer for Blanton & Cole, Architect-Engineers, of Tucson, Arizona. A registered professional engineer in Arizona, Missouri, Texas, and New Mexico, he has been associated with the Missouri Highway Department and the Southern Pacific Railroad.

Harold R. Wright has been named president of Cuddie Engineers, Inc., Birmingham, Michigan. Wright, both an architect and professional engineer, has been in private practice as a consultant since 1946. In other personnel changes announced by the firm, Calvin J. Saari was named manager of the structural detailing department, and William Gillett was made office manager.

Tudor Engineering Company, San Francisco, announces the following appointments: Louis W. Riggs, Jr., vice president; Arthur R. Reitter, vice president, and Stanley H. Froid, chief of structural and transportation division.

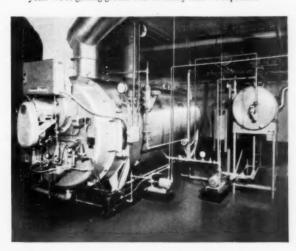
At the annual meeting of the Gulf Institute of Consulting Engineers recently held in New Orleans, officers were elected for the year 1961 as follows: president, C. Car-



## can you afford to recommend a boiler designed 20 years ago?

#### GETTING MORE HEAT FOR THE FUEL DOLLAR

The W. T. Rawleigh Company, manufacturer of toiletries, medicines and food products for the home and farm, replaced two old firebox boilers in their Memphis, Tennessee, branch with one fully automatic, combination-fired CB boiler. Mr. James Trindle, office manager, reports: "Our records show . . . 36.4% less fuel consumed during winter months that averaged about 12% colder than the previous year. We're getting greater fuel economy than we expected."



Since World War II, less than 20 years ago, fuel prices have soared. And these higher costs put a premium on "little" boiler inefficiencies that might have been ignored when most boilers were designed.

In the face of rising fuel costs, one manufacturer, Cleaver-Brooks, has led the way in up-to-date, "designed in" economy. Modern Cleaver-Brooks packaged boilers provide a combination of fuel-saving design standards that cannot be found in any other boiler — at any price.

It is this combination of features — four-pass design, forceddraft combustion, updraft construction and all the advantages of five square feet of heat-transfer surface per boiler horsepower — that puts fuel costs down where they belong.

All this is provided by Cleaver-Brooks in the most compact, automatic packaged unit on the market. Sizes through 600 hp...oil, gas and combination oil-gas firing...larger sizes in Cleaver-Brooks Springfield water-tube boilers. All models completely pre-engineered and tested as a package... expertly started by a trained field engineer.

See your local Cleaver-Brooks agent or write for a set of boiler-room templates designed for consulting engineers.



ORIGINATOR AND LARGEST PRODUCER OF FACKAGED BOILERS

CLEAVER-BROOKS COMPANY
Dept. G, 380 E. Keefe Ave., Milwaukee 12, Wisconsin



Never has to be removed from the line to replace the seat rings. For the first time in valve history, you can replace the seat rings in a renewable seat ring gate valve, under all normal conditions, in less than 10 minutes, using just a screw-driver, and with the valve body still installed in the line. It is simply a matter of removing the bonnet (easily accomplished with the Fairbanks two piece union bonnet construction) loosen the stainless steel retaining screws and lift out the monel seat rings from the body. The new seat rings slip into place and are positively secured again with the retaining screws.

Fairbanks new 200 pound steam working pressure gate valves, available in sizes ½" through 2" in the rising and non-rising stem construction, have been field tested for over two years under all conditions from steam to corrosive liquids and have proven completely satisfactory—absolutely dependable. Seat rings have been replaced in from 7 to 10 minutes from the time steam was shut off until it was turned on again. In several instances, it was reported that the replacement was performed in just 4 minutes.

This new patented valve design is typical of the sound engineering and outstanding values found in Fairbanks complete line of Bronze and Iron Body Valves.

YOURS ON REQUEST: Illustrated, descriptive folder gives complete information on Fairbanks Renewable Seat Ring Gate Valve, with details and specifications. Yours without charge. Write today.

#### \* Fairbanks COMPANY

393 Lafayette Street, New York 3, New York Branches: New York 3 \* Boston 10 \* Pittsburgh 22 \* Rome, Ga. Valves \* Trucks \* Casters \* Wheels \* Dart & "PIC" Unions



1 Retaining screw loosened with ordinary screwdriver.



2 Finger hooks inside seat ring. Seat ring lifted out of valve body.



3 New seat ring is inserted. Retaining screw tightened.



4 Bonnet replaced on valve

ter Brown, Baton Rouge; first vice president, Thomas C. David, Alexandria; second vice president, E. Carlton Guillot, Jr., New Orleans; secretary-treasurer, Jack Perrault, Baton Rouge; board members, Warren G. Moses, New Orleans, Leo M. Odom, Baton Rouge, and Alfred R. Salzer, Jr., New Orleans.

The Austin Company, engineers and builders, Cleveland, Ohio, announces the election of Edmund W. Hollister, manager of the firm's Cleveland district, and Charles R. Wing, manager of the southwest district (Houston, Texas), as vice presidents. Also, William Vanderhout has been appointed assistant general sales manager, with head-quarters at the company's general offices in Cleveland.

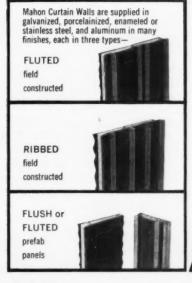
The firm name of O'Mara and Flodin, Inc., Los Angeles consulting engineers, has been changed to O'Mara Associates, Inc. Carl R. Flodin, engaged in dust and fume control engineering, has offices at 2744 Monterey Road, San Marino, California.

Frank Giuliano and Leon Nadolski have formed a partnership for the practice of consulting engineering in the fields of civil and structural engineering, with offices at 700 Montgomery Street, San Francisco, California. Giuliano has been in private practice since 1959, and Nadolski has been with Bechtel Corporation, of San Francisco, for the past seven years.

At its 113th annual meeting, the Boston Society of Civil Engineers elected new officers for the coming year. They are: president, James F. Brittain, Stone & Webster Engineering Corporation; vice president, George G. Bogren, Weston & Sampson; secretary, Charles O. Baird, Jr., Northeastern University; treasurer, Paul A. Dunkerley, Tufts University; and directors, Alexander J. Bone and Harry L. Kinsel. Edward C. Keane, Fay,



This joint Canadian-American project (for the Power Authority of the State of New York and the Hydro-Electric Power Commission of Ontario) points up how Mahon Metal Curtain Walls offer a practical answer to many architectural, structural... and budget problems. Whether your current or future projects are large or small, ground-hugging or cloud-reaching, industrial or commercial—investigate all the advantages of Fiberglas-insulated Mahon Curtain Walls. There's a type to suit your every requirement. Details in new Catalog CW-61. Write for it or ask your local Mahon architectural representative to drop one by.



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#### CONSTRUCTION SERVICES

· Structural Steel-Fabrication and Erection · Steel Fabrication-Weldments . Geodesic Domes-Fabrication and Erection

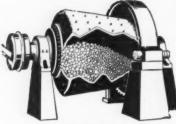
#### THE R. C. MAHON COMPANY

DETROIT 34, MICHIGAN

Manufacturing Plants-Detroit, Michigan and Torrance, California Sales-Engineering Offices in Detroit, New York, Chicago, Torrance and San Francisco

Representatives in all principal cities.

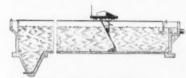
## HARDINGE Process Equipment



#### GRINDING MILLS

GRINDING MILLS

Conical and Tricone Ball and Pebble Mills are used for grinding wet or dry, in open or in closed circuit, either for granular or fine products. The shape of these mills causes a rapid circulating and classifying action, which increases capacity for power expended over other types. Rod, Batch, Cascade and Disc-Roll Mills also offered.



#### RECTANGULAR CLARIFIERS

Especially suited for limited spaces or where sludge delivery is desired at one end of the tank. A traveling scraper and skimmer carriage removes settled solids from the tank bottom and scum from the



#### CIRCULAR CLARIFIERS

Hardinge Circular Clarifiers are available in sizes up to 200' diameter, either center-column or beam supported for steel, concrete, wood or tile tanks, Sludge scrapers settled solids rapidly through remove settled solids rapi central underflow discharge



#### ROTARY COOLERS

Ruggles-Coles Rotary Coolers are employed for cooling hot materials after high temperature drying or calcination. There are four types: the gas-cooled type, the water-cooled shell type, the internal water-tube type, and the direct-contact water type.



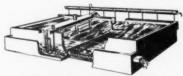
#### ROTARY DRYERS

There are seven distinct types of Ruggles-Coles Double and Single Shell Rotary Dry-ers, designed for direct, indirect and steam heat in from four to ten sizes for each type. Rotary Kilns also offered in sizes up to 100' in length.



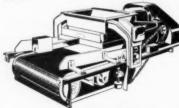
#### FLOCCULATING UNITS

Slowly rotating paddles on vertical shafts bring the small flocs into contact to form larger masses and hasten precipitation.



#### AUTOMATIC BACKWASH FILTERS

For high removal of non-settling or slow settling suspended matter. Self-cleaning sand bed. No shut-down necessary for backwashing. Traveling backwash mech-



#### CONSTANT-WEIGHT FEEDERS

CONSTANT-WEIGHT FEEDERS

The Hardinge Constant-Weight Feeder measures and feeds by weight instead of volume, eliminating variations due to specific gravity or changes in size of material. It feeds coarse or fine materials without choking, and operates successfully with rolls, crushers, ball mills, dryers, kilns, mixers, conveyors and like equipment. Capacities range nt. Capacities range to 200 tons. successfully with rolls, crumills, dryers, kilns, mixers, and like equipment. Capac from 1 lb. an hour to 200 to

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Write for Hardinge Process Equipment Catalog, Bulletin 100-B-64



Spofford & Thorndike, Inc., was presented with the Desmond Fitz-Gerald Medal, and the Sanitary Section Award was presented jointly to John S. Bethel, Jr., Clair N. Sawyer, and Charles Y. Hitchcock, Jr., of Metcalf & Eddy.

Brigadier General Clarence Renshaw has been appointed a vice president of Frederic R. Harris, Inc., consulting engineers, New York City. General Renshaw, who retired from active service last November after 31 years as a commissioned officer in the United States Army, was, at the time of his retirement, Director of Military Construction in the Office of the Chief of Engineers, Department of the Army, Washington, D. C.



RENSHAW



WASHBOURNE

General Lee Bird Washbourne, formerly director of the Oklahoma Highway Department, has been appointed project manager of Midland Engineering Company, Oklahoma City.

Western Independent Research Laboratories, Inc. has been incorporated for \$500,000 by a group of independent California laboratories. It will engage in applied technical research. Headquarters are at 4101 N. Figueroa Street, Los Angeles, with other offices in San Diego, San Francisco, and Sacramento. Officers are: president, Philip W. Helsley, of Testing Engineers, Inc., San Diego; vice presidents, Dr. Philip J. Charley, of Truesdail Laboratories, Inc., and Richard P. Beedle, of George W. Gooch Laboratories, Ltd., both of









# Memo to the engineer who hasn't used microfilm cards as yet!

**No doubt** you've read about Recordak precision microfilm images mounted in aperture cards, and how they are speeding routines in drafting rooms large and small.

But you may have some questions . . . are perhaps wondering just how they can help on your job.

For a start, consider a few of the advantages: you'll be able to keep all of your drawings—thousands of them—in a small card file at your finger tips. You'll be able to refer to any one of them in seconds in a Recordak Film Reader... no more "waiting" for costly prints every time you want to check a drawing. Whenever needed, low-cost, paper facsimiles—or duplicate film cards—can be made in seconds directly from the master card.

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originator of modern microfilming
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IN CANADA contact Recordak of Canada Ltd., Toronto

There's much more to the story. You must see for yourself how Recordak precision microfilming reproduces drawings of all types and ages with remarkable uniformity; how it gives you "drawings in miniature" that more than meet DOD requirements. Then you'll have a better idea why so many leading companies use Recordak microfilm-in-cards.

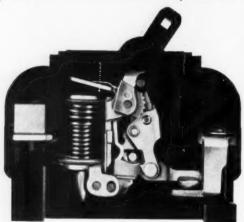
Free booklet goes into more details on precision microfilming available through Recordak or a microfilming dealer of Recordak.

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This breaker . . . costs more than plug-in's . . . isn't sold in stock panelboard assemblies . . . and can't be bought off-the-shelf from every distributor. Yet many consulting P. E.'s specify it job after job—by name! Why? Because there is simply no "or equal" for it. This breaker is uniquely different. This breaker is a Heinemann hydraulic-magnetic circuit breaker. It is completely non-thermal in operation and is not, therefore, adversely affected by above-normal ambient temperatures.

It never has to be de-rated. It will carry 100% nominal rated load through any temperature range.

And it will always



trip precisely as specified. These capabilities we put in writing. You'll find them spelled out explicitly in our published literature. • Heinemann circuit breakers in various models can be furnished in any standard current rating up to 200 amps, with your choice of several inverse time delays. Complete panelboards are available to your specifications from a number of custom panelboard assemblers throughout the country. Your inquiry is invited. For technical data, request Bulletins 3103 and 3110.

#### HEINEMANN ELECTRIC COMPANY

127 BRUNSWICK PIKE



Los Angeles; secretary, William M. Mullene, of Abbot A. Hanks, Inc., San Francisco; treasurer, Frank W. Barley, of American Spectrographic Laboratories, San Francisco.

New address of McKinney, Verner & Associates, civil engineers and surveyors, is 3249-A Stevens Creek Boulevard, San Jose, California.

Slocum & Fuller, consulting engineering firm of New York City, has announced the opening of a branch office in Sydney, New South Wales, Australia. The new office is in association with the Australian structural and civil firm of Rankine & Rill, and is located at 40 Miller Street, North Sydney, NSW, Australia. Daniel Barton, senior associate at Slocum & Fuller, is the associate in charge of mechanical and electrical design in the Australian organization. Morris Savitt, also from the New York office, currently is in Sydney working with Barton on lighting and electrical design.

Ib Falk Jorgensen, consulting engineer, in Denver, Colorado, announces the incorporation of his firm with Jorgensen as president, Fred Ruckhaus as vice president, and Fred E. Hendrickson as secretary-treasurer. The firm, under the name Ib Falk Jorgensen Consulting Engineers, Inc., will continue in the practice of civil and structural engineering at 1240 West Bayaud Avenue, Denver. In addition, Jorgensen announced the opening of a branch office in Albuquerque, New Mexico. It is anticipated that Fred Ruckhaus will be in charge of the branch office.

At the annual meeting and symposium of the Association of Consulting Chemists and Chemical Engineers, Inc., the following officers for the year 1960-61 were announced: president, Dr. Eugene W. K. Schwarz, New York City; vice president, Dr. Robert Steckler, Cleveland; secretary, Emerson Ven-



Installing Saran lined drainage system. Clevite Corporation Division.

### SARAN LINED DRAIN LINE cuts installation time 66%, handles vicious acids without corroding

The 400 saran lined fittings and 1200 feet of saran lined header line and branches in Clevite Corporation's Waltham, Mass., transistor plant were installed using regular plumbing tools with special cutters in one-third the time required for other corrosion-resistant drain systems. Saran lined drain line and fittings have no leaded joints—and are so strong that joints can be placed ten feet apart.

"This drain system was installed to carry combined mixtures of water, aqua regia, hydrofluoric, nitric and other acids from the production floor to a waste treatment tank. Even concentrated nitric acid, on occasion," said Plant Engineer Charles Kettendorf. "We use these acids to etch and clean the metals on our production line." Saran lined fittings are available in both union and flanged types. Where space is limited, as in thin wall-sections, saran lined fittings can be used where leaded-joints are too bulky to fit. They are ductile—won't crack no matter how hard you lean on the wrench.

When you need processing or laboratory drainage systems with great strength and corrosion-resistance, specify saran lined drain pipe and fittings. They'll take pressure ranging from full vacuum to 150 psi. and temperatures from  $-20^{\circ}$  F. to  $200^{\circ}$  F. They can easily be cut, fitted and modified using regular plumbing tools. For more information, write Saran Lined Pipe Company, 2415 Burdette Avenue, Ferndale, Michigan, Dept. 1575LW6.

THE DOW CHEMICAL COMPANY



Midland, Michigan



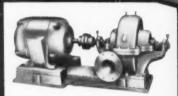
#### CENTRIFUGAL PUMPS

SMOOTH PERFORMANCE

• EASY MAINTENANCE

HIGH CAPACITIES

Type OJ Horizontally Split Single Stage Double Suction, Bulletin 105-C.



Type AJ Harizontally Split Two Stage Opposed Suction, Bulletin 106-B.



Type AJ Diagonally Split Two Stage

Bulletin 106-DS

- Capacities to 6000 GPM—heads to 600 feet—continuous operation.
- Both suction and discharge on bottom half of case...piping or motor-pump alignment never disturbed...lugs on top half of case for easy removal...by-pass in lantern ring exposed in lower half of case...fast, easy to inspect, clean and maintain...lines are back in operation fast!
- Streamlined liquid flow . . . hydraulically and dynamically balanced impellers . . . perfect alignment with in-line boring with top half of case in position . . . large standardized shaft sizes for maximum strength . . . short bearing centers for maximum rigidity and balance . . . low NPSH . . . smooth, long-term top performance . . . long life!

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able, Pittsburgh; and treasurer, Martin Aaron, New York City.

Robert A. Murphy has become a partner in the Phoenix, Arizona, consulting engineering firm of Williams and Ellis.

Announcement has been made of the admittance of Reed A. Troxel to partnership in the Syracuse, New York, consulting engineering office of Stuart H. Snyder. Troxel formerly was project structural engineer of Bellman, Gillett and Richards, in Toledo, Ohio. The new partnership will continue to furnish structural engineering services under the name of Snyder & Troxel, consulting engineers.

Ragon & Valentine, consulting engineers, announce the association of J. Phillip Hall with their office and the removal of their office to Suite 305, Park Central Building, Memphis, Tennessee.

Christopher J. Foster, consulting engineers, New York City, announces that it will be represented in Texas by Captain Theron P. Davenport. Captain Davenport recently retired from Texaco's marine department.



DAVENPORT



POTTER

At the annual meeting of Lockwood Greene Engineers, Inc., J. Robert Potter was elected president and treasurer. Except for service in the Navy, Potter has served Lockwood Greene continuously since 1939. He became a director in 1951, vice president and manager of the Boston office in 1953, and



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meters provide direct totalization, quickly read at a glance on a 6-digit straight reading totalizer. No computations or tables need be consulted. The totalizer reads in any standard volumetric units-gallons, cubic feet, acre feet, etc. For installations that also require rate of flow, the Sparling Indicator - Totalizer may be used which provides both rate and totalization. For operating auxiliary equipment or remote instrumentation the totalizer is simply replaced with suitable controls.

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Ask your Sparling field engineer for further information, or write for Catalog has been responsible for the expansion of the office and the development of new fields of activity.

William J. Heiser, president and treasurer since 1954, moved up to chairman of the board, succeeding Samuel B. Lincoln, who remains as director and honorary chairman of the board.

Harland Bartholomew and Associates has announced the assignment of Thomas A. Campbell to its Memphis office as part of the firm's expansion of its operations in the mid-south area. Campbell, associated with the firm for six years, has been resident planner in Beaumont. Texas.

Kenneth V. Marr, Charles H. Grimes, and R. Joe Wood have become partners in the firm of Arthur A. Sauer and Associates, civil and structural engineers, Sacramento, California.

Norman G. Marks has been elected a partner in the firm of Richardson, Gordon and Associates, consulting engineers, of Pittsburgh and Philadelphia, Pennsylvania.

John M. Ferry, until recently Special Assistant for Installations to the Secretary of the Air Force, has joined the staff of Metcalf & Eddy, consulting engineers, of Boston.

A new firm, Brandt and Morse, consulting engineers, Richmond, Virginia, has been formed. Principals are William G. Brandt, Jr., formerly with Samuel N. Mayo, Architect, and Robert F. Morse, formerly with J. Robert Carlton and Associates. The new firm, engaged in the engineering and design of heating, ventilating, air conditioning, electrical, plumbing, and sewage systems, is located at 112 East Cary Street.

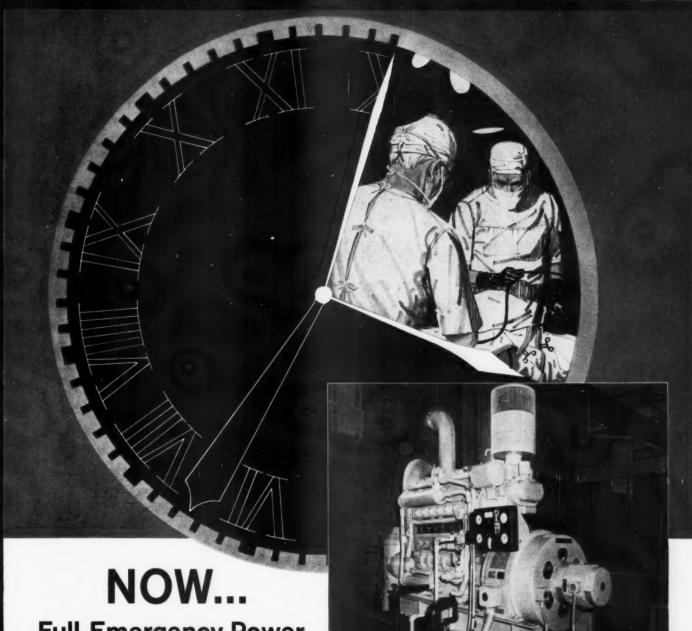
Kenneth R. Wright, formerly a partner of Wheeler and Wright, announces the formation of Wright Water Engineers, in Denver, Colo-

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rado. The new firm offers services in hydrology, water supply, water rights, and the design and construction of facilities for the utilization of municipal, agricultural, and industrial water. Offices are located at 1240 West Bayaud Avenue.

New directors of Jackson & Moreland, Inc., consulting engineers, Boston are: Raymond E. Cairns, vice president and treasurer; Henry W. Hills, vice president - appraisals and rates; Leo J. Myskowski, vice president - power plants; Arthur Y. Taylor, vice president - industrial, nuclear, laboratory, and testing facilities. Thomas A. O'Brien was elected assistant treasurer. Other continuing directors and officers are: Frank M. Carhart, chairman; John R. Coffin, president; Alexander J. Tigges, vice president; Richard M. Nichols, clerk; and Hartley Rowe.

Frank F. Martin, formerly senior economist, Edison Electric Institute, has been appointed manager of sales, Investor Owned Utilities, for The Kuljian Corporation, Philadelphia engineers.





Montague S. Hasie, formerly with the Corps of Engineers, U.S. Army, Fort Worth, has become associated with Hasie & Green & Associates, engineers and architects, of Lubbock, Texas.

Laurie R. Russell, formerly with Black & Veatch, has been appointed manager of the Kansas City office of Bucher & Willis, consulting engineers and planners.







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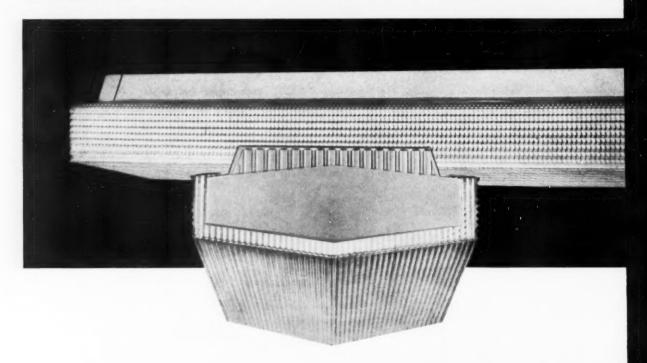
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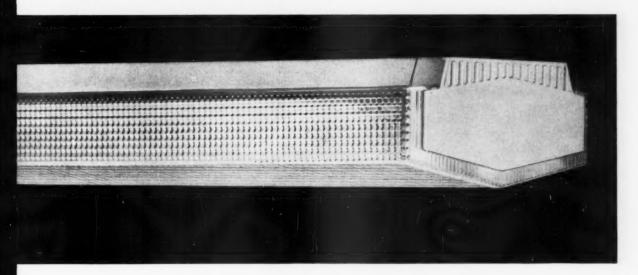
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The Consulting Engineer, by C. Maxwell Stanley; John Wiley & Sons, Inc., New York; \$5.95.

It is fairly safe and completely honest to describe this book as uniquely useful to those engaged in consulting engineering. In fact, this 258-page book is the only comprehensive guide available for practicing consultants or for graduates aspiring to the profession.

In 20 well-organized, concise chapters, the author blends current professional association data with his own 29 years' experience as a principal in a leading Midwest consulting firm. The text, crisp and easily read, is presented from the practical man's point of view.

The book is divided logically into two parts. Part 1 deals with the consultant's role in society and his relationship with the client. Part 2 studies the internal management of a consulting engineering firm - and this is where Stanley's experience counts heavily. It is obvious that the author took the rocky road to success, and, in the process, occasionally stubbed his toe. Like most who undertake a professional book, he hopes to keep others from kicking the same rocks. His candid remarks shed light on such thorny professional issues as what constitutes effective ethical advertising and sales promotion, how to nurture good public and client relations, how to deal fairly with competition, what fee schedule to use, how to hire and fire. which type of organization to use, and many other external and internal engineering affairs. Although the experienced consultant will undoubtedly find this book useful, its chief value would seem to be in training younger engineers coming up in a firm, and acquainting students with the field of consulting engineering.

Parts of the book appeared in the March and April issues of Consulting Engineer.

THE AMERICAN Book of Projects for THE AMATEUR SCIENTIST

Experiments and constructions, challings and describes in the fields of Astronomy, becaming, Boday, Ratural Sciences, Earth Sciences, Nuclear Physics, Mathematical Machines, Aerodynamics, lightics, finat, Einsteines, With 255 drawings and photographs.

C. L. STONG alreaded at Variety and Co.

The Scientific American Book of Projects for the Amateur Scientist, by C. L. Stong; Simon and Schuster, New York, New York; \$5.95.

Ever since the days of Tom Swift and his geodesic ping-pong ball, thousands of Americans have dreamed of making world-shattering scientific discoveries in their own basements, using only kitchen utensils and a penchant for tinkering. Very, very few have been successful. But from these legions of arm-chair Newtons has developed a solid core of serious, dedicated amateur scientists, who are willing to spend time - and money to repeat the work of professionals for their own education and entertainment. And these amateurs were fortunate enough to find a first-rate bible: The Scientific American. For many years, the "Amateur Scientist" column of the SA has carried accounts of the major projects and experiments carried out by its readers. This book is a collection of some of the more interesting among them.

The projects are described and explained quite briefly; the writer assumes the reader is already on familiar ground, and nicely avoids the irritating elaboration and oversimplification of most other "experiment" books. The projects are separated into categories according to scientific discipline, and are illustrated with the line drawings characteristic of the SA. It's an extremely interesting book, even if you don't try any of the projects.

A Survey of the Roads of the United States of America, 1789, by Christopher Colles, edited by Walter W. Ristow; The Belknap Press of Harvard University Press, Cambridge, Mass.; \$7.50.

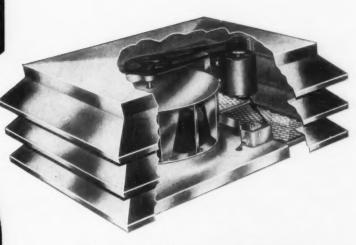
Whether Christopher Colles was a genius or an impractical visionary is hard to tell. He himself stated that had he been trained as a hatter, men probably would have come into the world minus heads. At any rate, Colles was an engineer and associated with some of the foremost engineers of his day, even though he died in poverty and loneliness.

The one permanent contribution which Colles made to history was his Survey of the Roads of the United States of America. Walter W. Ristow, assistant chief, Map Division, Library of Congress, has

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made a notable contribution to engineering history by doing a biography of this little known engineer and publishing a facsimile of the original edition of his book of maps.

As an Irish emigrant, Colles came to the United States just before the Revolutionary War. He pursued various careers as a lecturer, inventor, consulting engineer, and surveyor. The collection of maps that he left behind unfortunately is, like everything else he did, clouded in controversy. No one seems to be absolutely sure how much of Colles' map work he did himself and how much was taken from the earlier work of Erskine and DeWitt, who were geographers and surveyors for the Continental Army. It is certain that some of the work was Colles' own, and on this little fragment rests his claim to posterity.

Taxation and Operations Abroad, a Symposium; Tax Institute, Inc., Princeton, N. I.; \$6.00.

Consulting engineers who are interested in developing an overseas practice must face many tax problems. There is, of course, no substitute for expert legal advice, but this little book does an excellent job of reviewing the general subject of taxation on overseas operations. Actually, the third chapter is the only one which specifically deals with the type of operation the consultant would be most interested in. It is titled "Form of Organization for Service and Contract Agencies Engaged in Operations Abroad." The three possible types of organization open to the consulting engineering firms planning to practice abroad are detailed. These include the branch organization, the domestic subsidiary corporation, and the foreign subsidiary corporation. The tax situation on operations abroad is an intricate one, and this little volume may be more discouraging than encouraging to consulting engineers who are looking longingly at overseas projects.

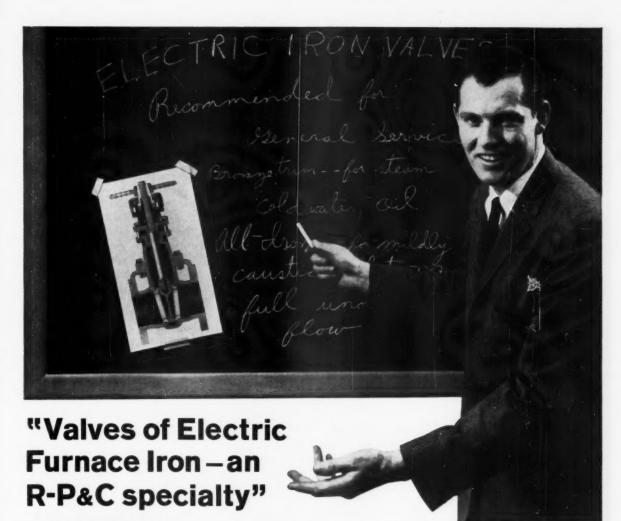
The Fading American Newspaper, by Carl Lindstrom; Doubleday, Garden City, New York; \$3.95.

Rarely is the title of a book so clear an indication of its contents as this one. Lindstrom, former editor of the Hartford *Times* and now professor of journalism at the University of Michigan, is highly critical of American newspapers — in the way only a man who knows and loves them can be. His book has been denounced pretty thoroughly in the press, but many of the denunciations have only borne out his conclusions.

That the American newspaper actually is fading is perhaps a matter of opinion. If you buy a paper for the crossword puzzle or the comics, for the sports page or the food ads, you probably are satisfied with what you get. But if you are anxious over the state of national or world affairs, you may be disappointed, and only the fortunate few in a limited number of cities can expect to find a thought-provoking editorial page.

Lindstrom blames much of the newspapers' decline on the point-less battle with radio and television. In the race to get the paper on the customer's doorstep before he turns on his television set, editors and publishers have had to sacrifice accuracy, style, and intelligibility. The author suggests that the papers might better admit that electronic communication is faster than they are, and concentrate on what the paper does best: extended, detailed coverage of all the news.

Most of the newspaper reviewers (those that bothered to notice it) have dismissed *The Fading American Newspaper* as carping and prating, as sour grapes. But often the reviews are written in the exact manner Lindstrom deplores; they





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Welcome, sir-and madame-to



Robert Sarason, General Manager Teletype NY-1-4295

are in editions full of second-rate reporting, misleading headlines, poor use of color, jumbled makeup and so on discouragingly.

Mathematical Snapshots, by H. Steinhaus; Oxford University Press, New York; \$6.75. Mathematicians - good and bad have tried for many years to write explanations of their esoteric world for the average man. Almost invariably, these books have failed of literary prominence, because the author wrote too high or too low, because he was too technical, or because he was too literary. One notable exception was Tobias Dantzig's Number. Another exception, not so notable, perhaps, but good nonetheless, is this English langauge edition of Steinhaus's 1950 work published in Poland.

Steinhaus is an outstanding mathematician, a professor of Applied Mathematics at the University of Wroclaw, Poland. The book was first published in Polish, and although the translation is rough in spots, it never gets rocky.

The book is well-illustrated, although the pictures tend to be a trifle disconcerting: they are clear, but they lack some of the flair we are accustomed to in American texts. There is nothing wrong with the pictures - they just have not been subjected to the U.S. glamorizing processes.

Much of the success of this book is the result of the author's ability to correlate pure mathematics with applied everyday-life. For instance, the titles of some of the chapters are: "Cubes, Spiders, Honeycombs, and Bricks;" "Squirrels, Screws, Candles, Tunes, and Shadows;" and "Boards of Fortune, Frogs, Freshmen, and Sunflowers." There are a few references that the average American may not fit easily into his everyday life - such as determining the best route for an Arab who wants to water his camel on the way back to the tent - but generally, the book is readable and interesting.

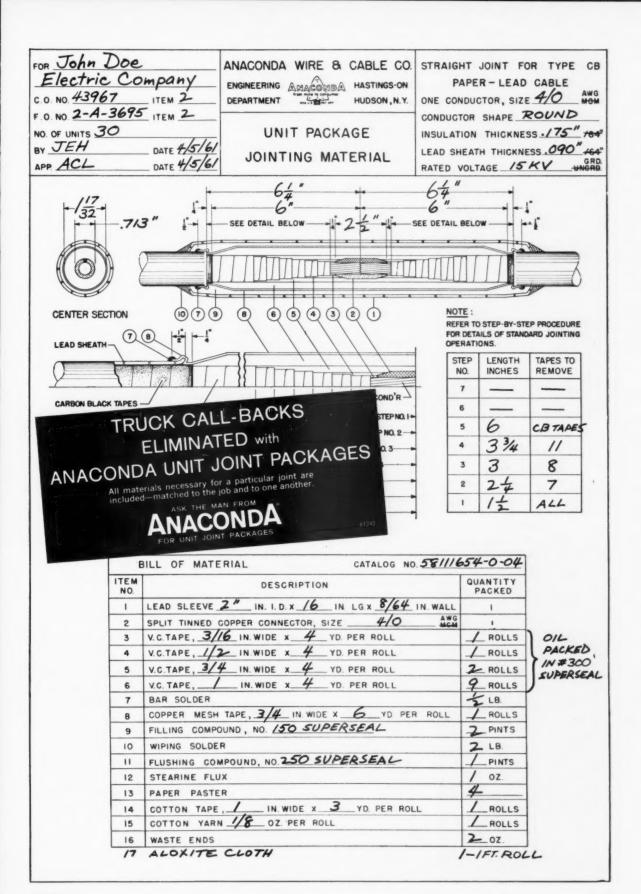
Lockwood Greene . . . The History of an Engineering Business, 1832-1958, by Samuel B. Lincoln; The Stephen Greene Press, Battleboro, Vt.; \$10.

The history of Lockwood Greene Engineers Inc. - all 861 pages of it - presents the evolution of the textile industry and the consulting engineering profession as well as of the firm, in what is surely the most complete record ever published about an engineering organization. Lincoln, who recently handed the reins as chairman of the board to W. J. Heiser, was the perfect choice for author. After 58 years with the firm, Lincoln knows all and tells all. In fact, the only criticism of the book is that too many men, projects, and statistics are included in the text for stayawake reading. The statistics and projects data easily could have been added to the appendix.

Lockwood Greene, the oldest consulting engineering firm in continuous operation in the U.S. (according to the records of the American Institute of Consulting Engineers), dates back to David Whitman, the "mill doctor," who became a consulting engineer in 1832.

Whitman's protege, Amos D. Lockwood, carried on the business after the founder's death. However, Lockwood waited until he was 40 and had experience in all phases of mill operation before undertaking design. One of the book's more interesting sidelights is a letter from Lockwood to his fiance proposing and explaining that he would have done so sooner but was out of a job. "In conclusion I would mention that the Salaries of Superintendents of large Establishments are usually from one thousand to twelve and fifteen hundred dollars." Quite a convincing argument at that time.

Lincoln takes the reader through the founding of textile mills in





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the New World, to the height of mill prosperity, and through textile decline. One of Lockwood's clients, in a speech shortly after the advent of rayon, summarized the situation, saying, "I'll tell you what's the matter with the cotton industry. There are only two cotton petticoats in this audience - and my wife is wearing both of them."

Lockwood died in 1884, leaving 33-year-old Stephen Greene in virtual charge of the business. The business continued to prosper. History repeated itself, and Lockwood Greene got another young president in 1901 when Greene died and left the business to his 22-year-old son, Edwin Farnham Greene. Young Greene almost immediately entered into mill management, and the firm owned and managed textile companies while continuing engineering as a subsidiary.

In the 1920s, when the textile business began a serious decline, the engineering division continued to show a profit. The parent company lost business steadily until mid-1928 when it was dissolved and the present Lockwood Greene Engineers Inc. was formed by a group that had been running the engineering for many years.

The dissolution caused heavy losses to the banks and to the public that had invested \$11 million in the holding company. Greene and his partners lost practically all they had, and he himself went deeply in debt. Not until 1941 did Lockwood Greene become free from debt, and during the past 16 years a total of \$25 million in fees was earned by the company.

#### **New Technical Books**

VIBRATIONS FROM BLASTING ROCK, by L. Don. Leet; Harvard University Press, Cambridge, Massachusetts; \$4.75. This most recent volume in the series of Harvard Monographs on Applied Science is a compilation of information currently available on vibrations caused by the detonation of explosives. The author considers the various factors involved, from the preparation of the charge and the nature of the rock, to the methods of recording shock waves.

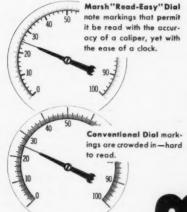
AUTOMATION, by Walter Buckingham; Harper & Brothers, New York; \$4.50. In about 180 pages, Doctor Buckingham tries to explain the causes and effects of the world of automation. Most of the book is devoted to exploration of the probable effects increasing mechanization and technology will have on different classes of people. The book is written for laymen, and may prove a little over-simplified for a technical man.

METROPOLIS, 1985, by Raymond Vernon: Harvard University Press, Cambridge, Massachusetts; \$5.00. This book is a digest of eight other books, all studying the Metropolitan New York region, produced by the Harvard University Graduate School of Public Administration. The books were the result of a three year study of New York as a typical metropolitan area. It was not the purpose of the authors to criticize, advise, or plan. They only studied what actually exists, and made careful predictions of the probable condition of the city in the next 5, 15, and 25 years. They considered population trends, job changes, commerce, industry, real estate values, and a hundred other factors. The conclusions of this book cannot be summarized; there are just too many of them. How accurate they are, we won't know for another 25 years.

EFFECTIVE REPORT WRITING, by Norman B. Sigband; Harper & Brothers, New York; \$6.75. It is generally impractical to ask one writer to criticize a second writer's book of instructions for a third writer; there are just too many different-butequally-right views on different aspects. However, Doctor Sigband







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seems to have done a very good job of explaining what is necessary in a report, how it is determined, and how it should be presented. The book might almost have been called Business Writing, because it covers so many fields of writing. It tells how to set up a company bulletin board, write a letter of complaint, and collect bills. Little of it is directed at the engineer as a technical man, but much of it will interest the consultant as a business man.

SCIENTIFIC THINKING AND SCIENTIF-IC WRITING, by Martin Peterson: Reinhold Publishing Corp., New York; \$6.75. Doctor Peterson makes what may be a rash assumption: if a man can think clearly, he can write clearly. From this, he proceeds to outline clear thinking, leaving to others the fine points of style, grammar, and so forth. If you are writing a scientific report, this book may be all you need. If you are writing an article for Con-SULTING ENGINEER, we suggest this book and the Strunk-White manual of style.

CERAMICS, by P. William Lee; Reinhold Publishing Corp., New York; \$5.95. Lee claims to have written the first comprehensive, single-volume survey of the entire field of ceramics. Probably, as a general introduction book, the claim is justified; but as a reference work it, undoubtedly skips much. In an age of incredibly fast scientific development, for any given topic, there is more information available than can be bound into one book. And between the time the book is written and the time it is published, much of the information will be obsolete, or erroneous.

OPTIMUM USE OF ENGINEERING TALENT, several authors; The American Management Association, New York; \$9.00 (\$6.00 to AMA members). Most of this book is directed to the management of large companies which employ

their own engineering staffs, and so may be of only incidental interest to the management of a consulting firm. However, there is a section on the use of outside help (consultants) that is very pleasantly weighted in favor of the consulting engineer. The author of this section assumes that big firms will maintain their own engineering departments, but advises that the department be small enough to be kept busy - when bigger or harder jobs come up, hire a consultant. The author also is realistic about the process of hiring a consultant.

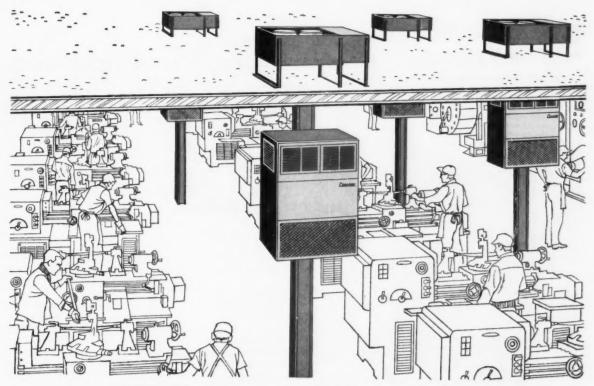
APPRAISAL AND ASSESSMENT DICTIONARY; by Richard Cherney; Prentice-Hall, Englewood Cliffs, New Jersey; \$10.00. Intended more for appraisers and assessors than for engineers, this book still might be useful for consultants in defining legal and real estate terms.

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HYDROMETRY: THEORY AND PRACTICE OF HYDRAULIC MEASUREMENTS, by A. T. Troskolanski; Pergamon Press, New York; \$18.00. This is a translation and revision of part of a standard Polish text on applied hydraulics and hydromechanics. This section deals primarily with the measurement of hydraulic flow and the methods and machines used. The author is Professor of Hydraulics at the Technical University in Wroclaw, Poland, and is an internationally recognized authority in the field.



Typical installation: Outdoor sections on the roof; indoor sections hung on columns.

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### Consulting Engineers' Calendar

June 4-9. American Water Works Association; Annual Conference, Detroit.

June 7. American Institute of Consulting Engineers; Luncheon Meeting, Engineers' Club, New York, N. Y.

June 8-9. 4th Annual Institute for Consulting Engineers; Management and Organization seminar; University of Wisconsin, Madison, Wisconsin.

June 11-15. American Society of Mechanical Engineers; Semiannual Meeting, Statler-Hilton, Los Angeles, Calif.

June 12. Instrument Society of America and Air Pollution Control Association; Air Pollution Instrumentation Symposium, Hotel Commodore, New York, New York.

June 18-23. American Institute of Electrical Engineers; Summer General Meeting, Ithaca, New York.

June 21-July 1. International Commission on Large Dams; 1961 Congress, Rome, Italy.

June 23-24. Missouri Society of Professional Engineers; Convention, Governor House, Jefferson City, Missouri.

June 25-30. American Society of Testing Materials; Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, New Jersey.

June 25-30. Pennsylvania State University; Engineering Seminar — "R and D Management Development," University Park, Pennsylvania.

June 26-28. American Society of Heating, Refrigerating and Air-Conditioning Engineers; Annual Meeting, Denver Hilton Hotel, Denver, Colorado.

June 26-30. American Society for Engineering Education; Annual Meeting, Univ. of Kentucky, Lexington, Ky.

June 28-30. Institute of Radio Engineers, American Institute of Chemical Engineers, Instrument Society of America, American Institute of Electrical Engineers, American Society of Mechanical Engineers; Joint Automatic Control Conference; University of Colorado, Boulder, Colorado.

July 5-8. National Society of Professional Engineers; Annual Meeting, Olympic Hotel, Seattle, Wash.

July 10-14. University of California Extension; Short Course — "Technical Report Writing for Engineers and Scientists," UCLA Campus, Los Angeles, California.

Aug. 16-18. Hydraulics Division, American Society of Civil Engineers; 10th Annual Hydraulics Conference, Campus, University of Illinois, Urbana, Illinois.

Aug. 20-24. University of Michigan; International Conference on Structural Design of Asphalt Pavement, Campus, Ann Arbor, Michigan.

Aug. 23-25. American Institute of Electrical Engineers; Pacific Meeting, Hotel Utah, Salt Lake City.

Aug. 28-Sept. 1. American Society of Mechanical Engineers; International Conference on Heat Transfer, University of Colorado, Boulder, Colorado.

Sept. 14-15. American Institute of Electrical Engineers and American Society of Mechanical Engineers; Engineering Management Conference, Hotel Roosevelt, New York, N. Y.

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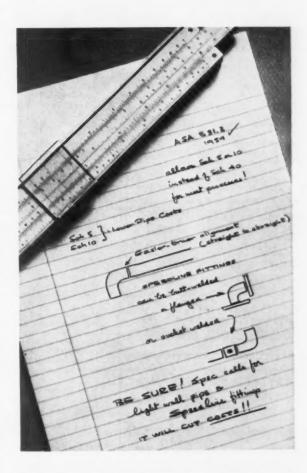
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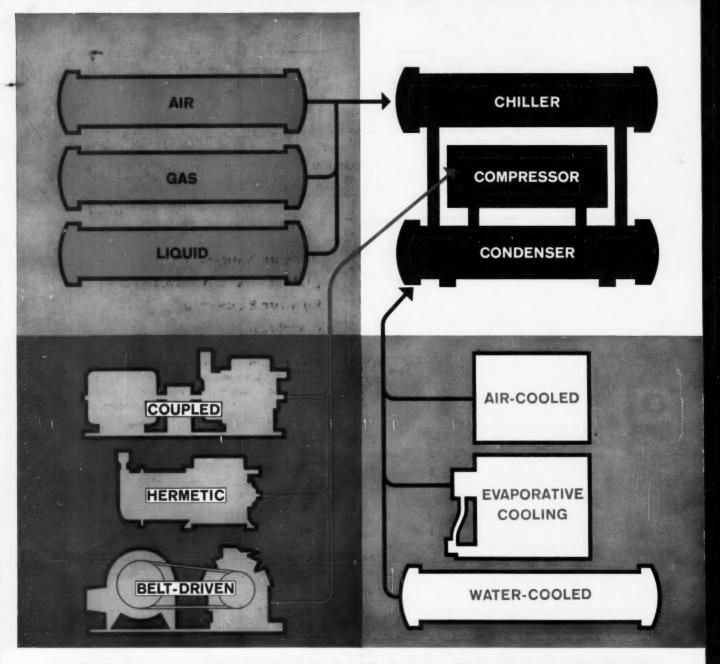
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